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147A/149A

NTSC TEST SIGNAL GENERATORS

INSTRUCTION MANUAL

Tektronix, Inc.
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Beaverton, Oregon 97077

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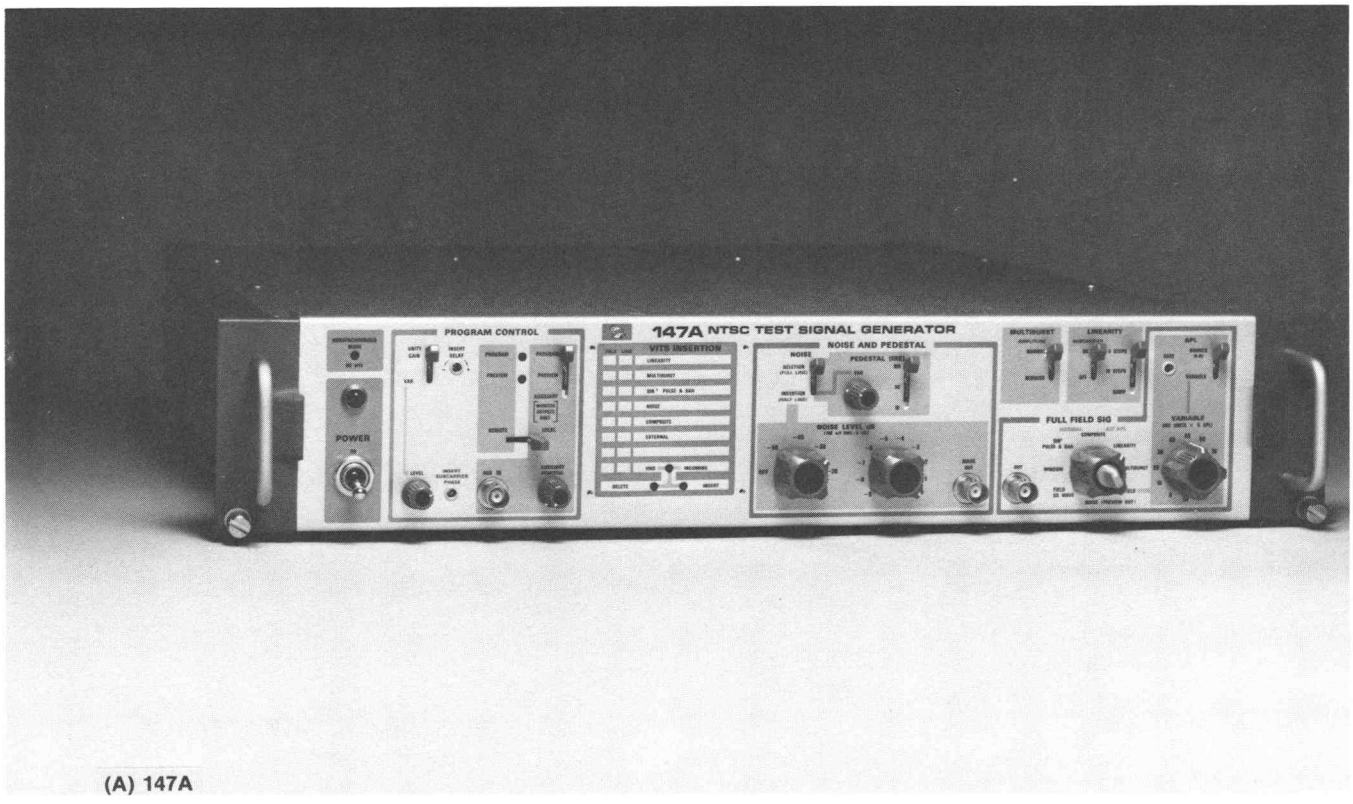
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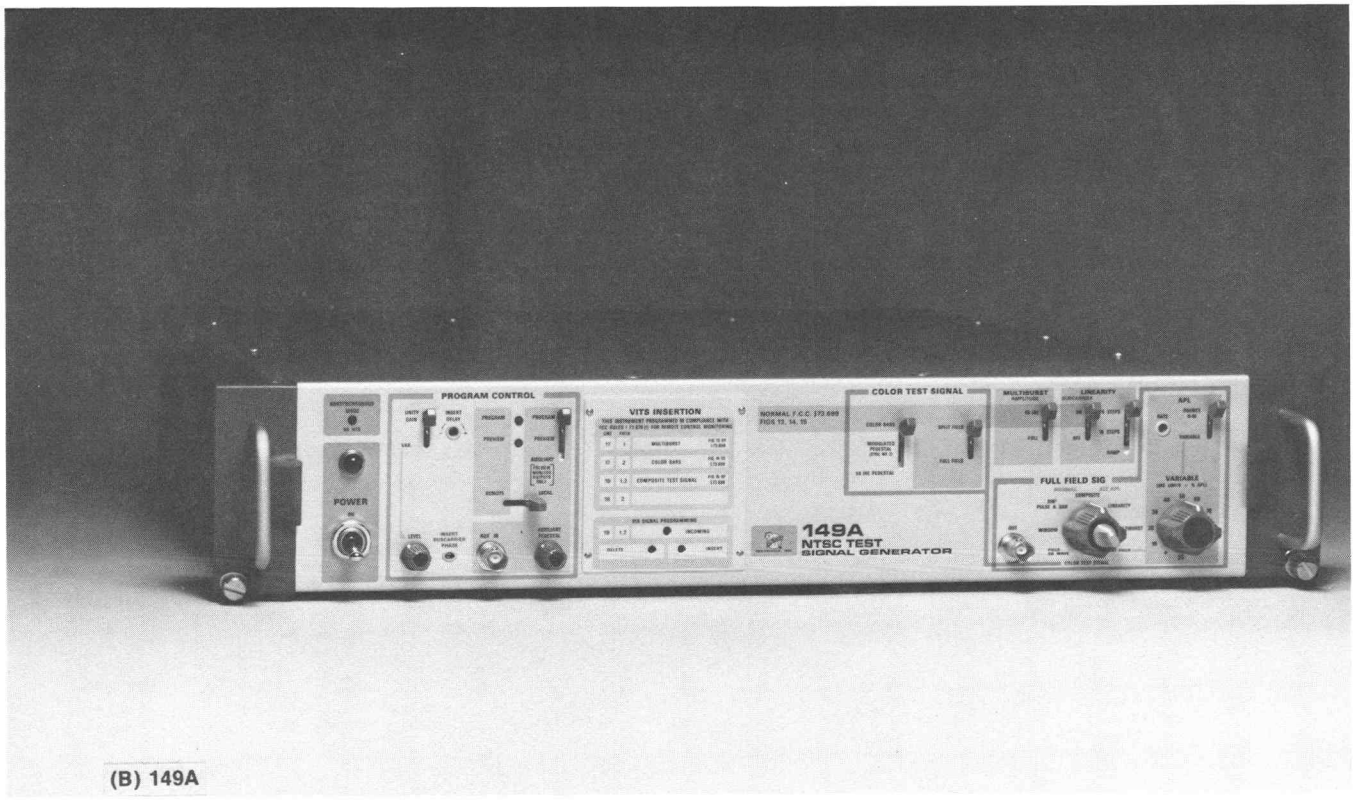
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CHANGE INFORMATION



(A) 147A



(B) 149A

Fig. 1-1. The 147A and 149A NTSC Test Signal Generators.

OPERATING INSTRUCTIONS AND SPECIFICATION

INSTRUMENT DESCRIPTION

The 147A and 149A NTSC Test Signal Generators are high-quality test instruments capable of providing a variety of functions useful in testing video systems or discrete parts of systems. Most of the test signals generated are available as full-field signals and as Vertical Interval Test Signals (VITS). The front-panel selected signals will accommodate most users; however, certain parameters may be changed by internal programming. Test signals available are: Noise (147A only), Flat Field, Multiburst, Linearity, Composite, Sin^2 Pulse & Bar, Window, Field Square Wave, Color Bars or Modulated Pedestal (149A only), and VIRS (Vertical Interval Reference Signal).

The 147A and 149A signals are Gen-Locked[1] to the incoming program signal or to a black burst master generator, assuring accurate timing and phasing of the output. A front-panel light activates with loss of incoming sync, indicating the free-running state of the instrument.

INSTALLATION

NOTE

Installation of this instrument should be performed or supervised by a qualified technician or engineer.

Rackmounting

Complete information for mounting the 140-Series of instruments in a standard 19" rack is given in Section 5 of this manual.

[1]**Synchronization of signals in both frequency and phase.**

Power Source

WARNING

This instrument is intended to be operated from a single-phase power source which has one of its current-carrying conductors (the neutral conductor) at or near ground (earth) potential. Operation from other power sources where both current-carrying conductors are live with respect to ground (such as phase-to-phase on multi-phase systems) is not recommended, as only the Line Conductor has over-current (fuse) protection within the instrument.

Operating Voltage

The 147A and 149A may be operated from either 115-Vac or 230-Vac (nominal) line voltage sources. Quick-change line-voltage plugs, located under the fuse cover on the rear panel, change the transformer primary connections. The plugs permit one of three line-voltage operating ranges to be selected. Table 1-1 lists the voltage ranges that enable the instrument dc power supplies to regulate properly.

To convert to a different line voltage, proceed as follows:

1. Disconnect the 147A or 149A from the power source.

2. Unscrew the two captive screws holding the fuse cover. Remove the cover and attached fuses.

3. Pull out the 115/230 Voltage Selector plug (see Fig. 1-2), then rotate the plug 180° and insert it into the opposite set of holes. The 115/230 Voltage Selector plug is located in the upper position for 115 V operation, and in the lower position for 230 V operation.

4. To change the line-voltage operating range (LO, M, or HI), pull out the Range Selector plug (see Fig. 1-2) and insert it in the desired hole locations. Select a range with a center voltage (see column 3 in Table 1-1) closely corresponding to the line voltage that will be applied in regular instrument operation.

TABLE 1-1

115/230 Voltage Selector Plug Position	Range Selector Plug Position	Nominal Line (Center) Voltage	Line Voltage Plug Range[2]	Fuse Values
115 V	LO (Low)	100 Vac	90 to 110 Vac	0.75 A
	M (Medium)	115 Vac	104 to 126 Vac	Fast-
	HI (High)	124 Vac	112 to 136 Vac	Blow
230 V	LO (Low)	200 Vac	180 to 220 Vac	0.5 A
	M (Medium)	230 Vac	208 to 252 Vac	Fast-
	HI (High)	248 Vac	224 to 272 Vac	Blow

[2]**Applicable when the line contains less than 2% total distortion.**

5. Re-install the cover with two captive screws and fuses. Be sure the cover fits firmly against the rear panel. This indicates that the line fuses are seated properly in the fuse clips.

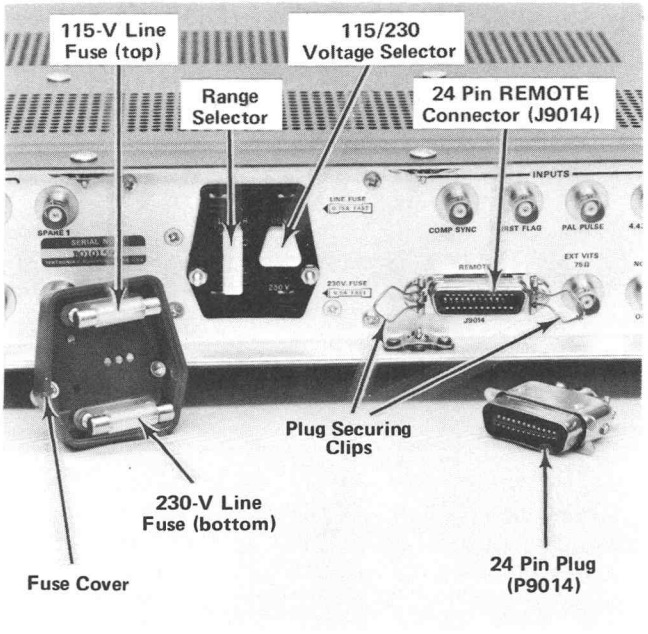


Fig. 1-2. Location of Range and Voltage Selector plugs with fuse cover removed (plugs are set for 115-V medium range operation as shown). Also shown is the REMOTE connector (J9014), Plug (P9014), and plug securing clips.

6. Before applying power to the instrument, check that the indicating tabs on the selector plugs protrude through the proper holes in the cover for the correct line voltage and the proper operating range.

CAUTION

The 147A and 149A should not be operated with the 115/230 Voltage Selector and/or Range Selector plugs in the wrong position for the line voltage applied.

Local/Remote Connector

The 147A or 149A may be installed at one location and functionally-controlled from a remote location by means of the REMOTE connector-plug (J9014-P9014) and the LOCAL/REMOTE switch. FULL FIELD and PROGRAM/PREVIEW switching is available at the front panel and at the REMOTE connector. In addition, the REMOTE connector provides access for switching of Sync Source, NORM/BYPASS, VIRS insert-delete, and for relay control of the CW Subcarrier. The REMOTE plug comes factory-wired for LOCAL operation as shown in Fig. 1-3.

To operate in REMOTE, separate switching must be used at the remote location(s). Typical wiring for remote switches, with their connections to the REMOTE plug, is shown in Fig. 1-4. Pin 6 of the REMOTE plug has a multiple purpose. It can be grounded to provide CW Subcarrier at all times whether burst is present or absent. Also, pin 6 can be used as an output to control circuitry as a function of burst presence. When incoming burst is present, the level at pin 6 will be low, about 0 volt. If burst is absent, the output will be high, about 5 volts. This high level is obtained through relay K390; therefore, any circuit driven by the high level must be of sufficiently high impedance to keep K390 from activating.

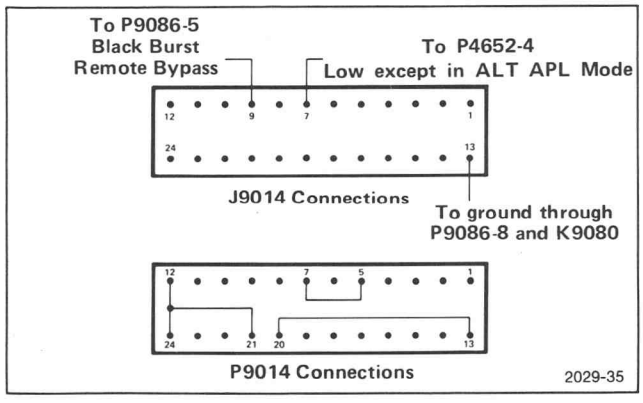


Fig. 1-3. Wiring diagram of Remote Plug for LOCAL operation (factory connected).

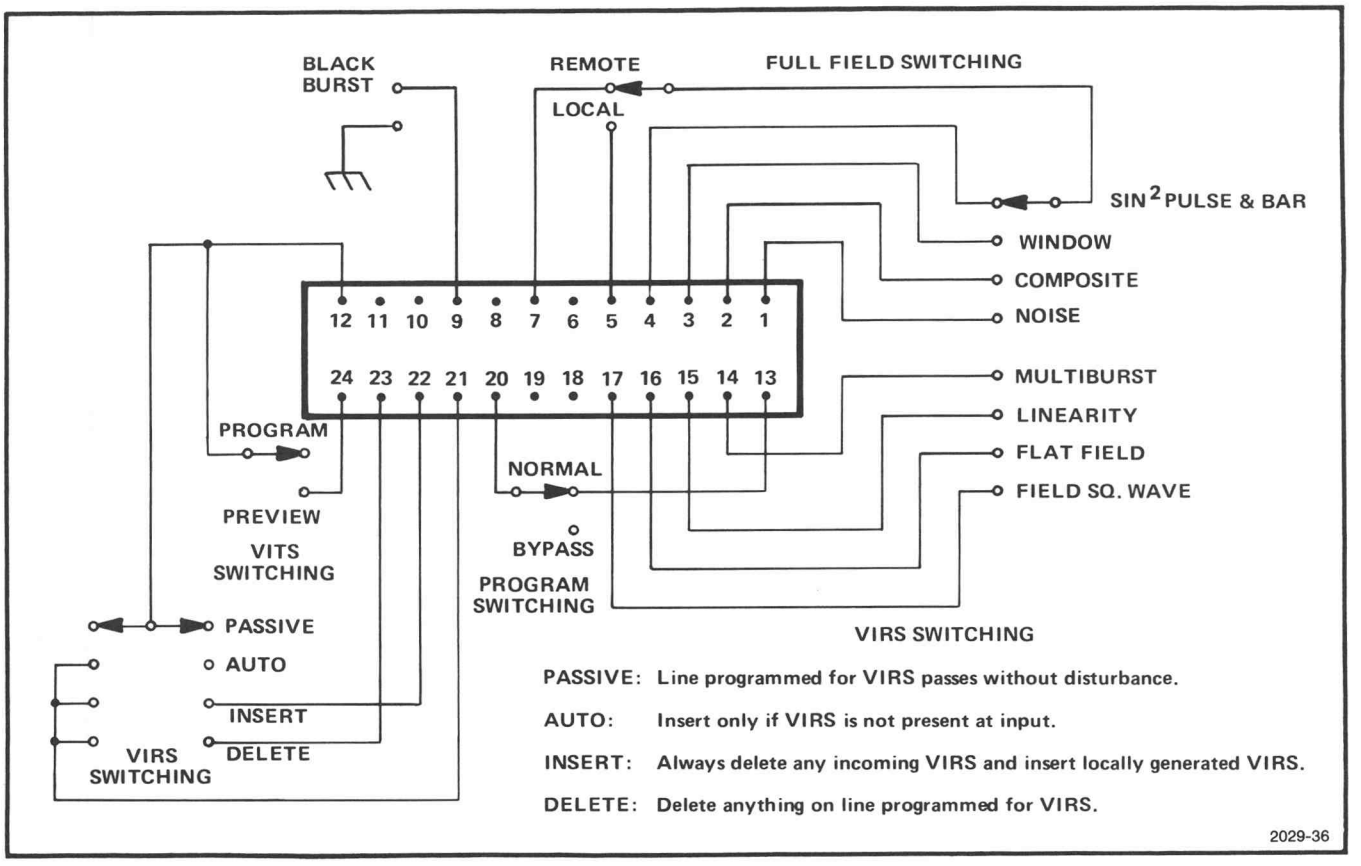


Fig. 1-4. Wiring Diagrams for REMOTE operation.

NOTE

Due to the many possible combinations of cable lengths and configurations, it may be necessary to compensate for the reactance added to the 147A or 149A circuitry by the remote cabling.

BNC-T Connectors

A pair of BNC-T connectors are supplied as accessories to this instrument. These connectors should be installed on the PROGRAM LINE IN and PROGRAM LINE OUT connectors. When the instrument needs to be removed during a program, a short coaxial cable connected between the two BNC-T connectors allows program continuity. (See Fig. 1-5.)

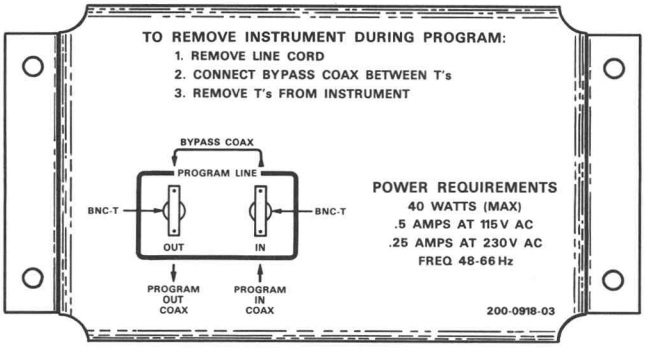


Fig. 1-5. Installing the BNC-T connectors.

Repackaging

If this instrument is to be shipped long distances by commercial transportation, repackage it in the original manner for maximum protection. The original shipping carton can be saved and used for this purpose. An illustration in the Maintenance section, Fig. 2-4, shows how to repackage the instrument. Contact your local Tektronix Field Office, Service Center, or Representative for shipping instructions.

FRONT- AND REAR-PANEL DESCRIPTION

Introduction

The following describes the function or operation of the various controls and connectors found on the front- and rear-panel of the 147A and 149A. Front-panel controls are functionally-grouped for ease in operation. Each major function (Program Control, Full Field Sig, etc.) is identified and enclosed within an outlined area on the panel. Individual controls related to each function are enclosed within the separate outlined areas. Refer to Figs. 1-6, 1-7, and 1-8 as these items are explained.

Front-Panel

1 POWER	Toggle switch to turn instrument power ON and OFF.
2 POWER ON Lamp	Green light which indicates when the POWER switch is ON and the instrument is connected to a line voltage source.
3 NONSYNCHRONOUS MODE—NO VITS	A red light indicates the absence of incoming sync information. In this condition, no VITS will be inserted. Full-field signals are generated, but line and field sync are not locked to subcarrier.
4 PROGRAM CONTROL	Consists of three level switches, four variable controls, and two indicator lamps to: select signal modes, control their amplitude, phase, and timing relationships, and indicate operating status.
5 UNITY GAIN/VAR	UNITY GAIN position selects unity gain between the program input and the program output. The VAR position connects the front-panel LEVEL control.
6 LEVEL	This control varies the gain of the program amplifier, allowing the incoming signal to match the inserted signal amplitude.
7 INSERT DELAY	A screwdriver adjustment which permits time-positioning of the internally-generated VIT signals with respect to the incoming signal.

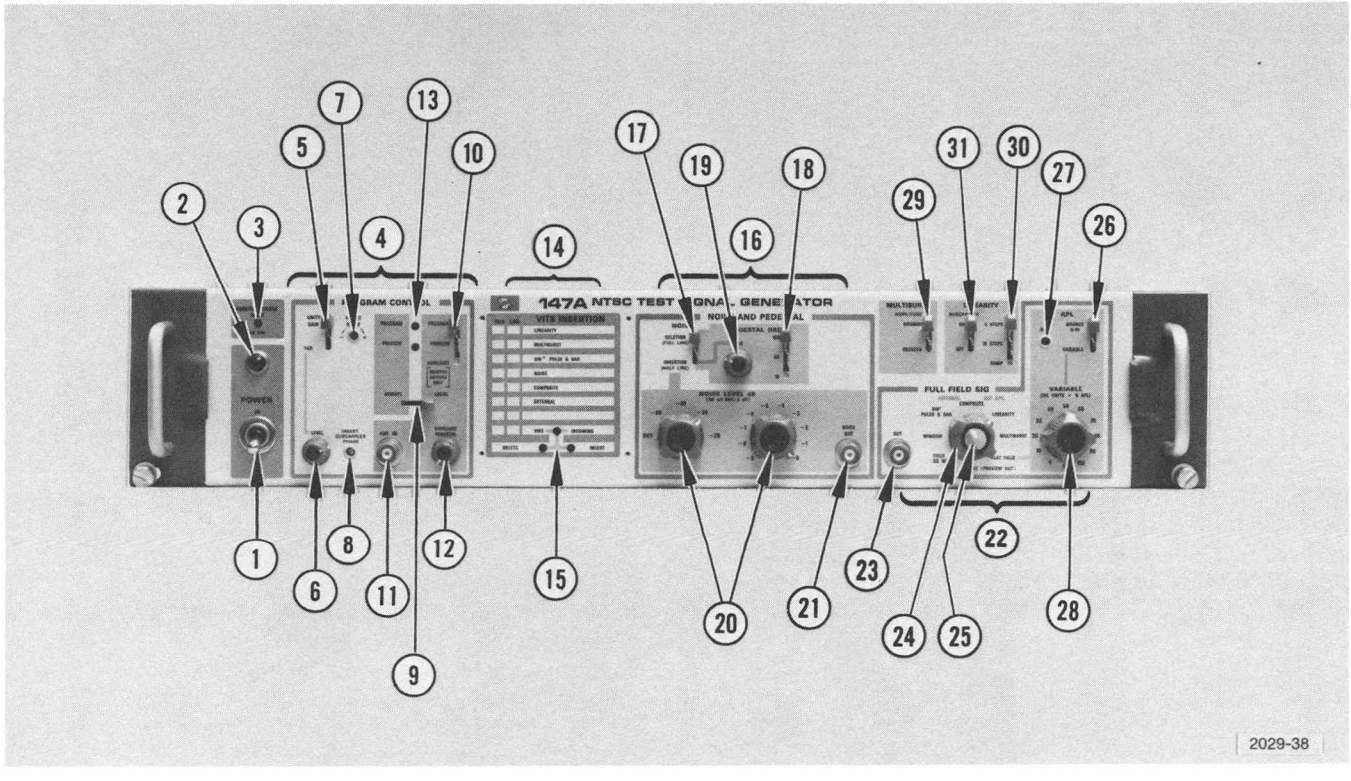


Fig. 1-6. 147A front-panel controls and connectors.

8 INSERT SUB-CARRIER PHASE — A screwdriver adjustment which permits setting the phase of the color subcarrier on internally generated signals with respect to the incoming color burst signal.

9 LOCAL/REMOTE — The LOCAL position enables front-panel control of the 147A or 149A Program or Preview modes. In the REMOTE position, operation is controllable by connection of a remote switching circuit to the rear-panel REMOTE connector (see Fig. 1-4). With the factory-wired REMOTE plug connected, the instrument will be in the PREVEIW mode when this switch is in REMOTE.

10 PROGRAM/ PREVIEW/ AUXILIARY — The PROGRAM position inserts VITS on the PROGRAM, PROGRAM MONITOR, and PREVIEW MONITOR outputs.

The PREVIEW position inserts VITS on the PREVIEW MONITOR outputs only, allowing verification prior to inserting VITS on PROGRAM OUT.

The AUXILIARY position permits a non-video signal to be inserted on a pedestal during active video time. The resulting composite video signal is available at the PREVIEW MONITOR OUTPUTS.

11 AUX IN — BNC input connector. Accepts non-video signal (e.g., sinewave or sweep generator signals) and inserts it on a pedestal during active video time. The combined signal appears at the PREVIEW MONITOR OUTPUTS when the instrument is in the AUXILIARY mode.

12 AUXILIARY PEDESTAL — Controls the level of the AUXILIARY signal with respect to the blanking level. This allows positioning between the white and black levels.

13 PROGRAM/ PREVIEW Lamps — When in REMOTE, the status of the instrument may not be indicated by the position of the PROGRAM/PREVIEW/AUXILIARY switch. Green and yellow lamps indicate the actual operating mode of PROGRAM and PREVIEW, in that order, whether in LOCAL or REMOTE. All lamps "out" indicate that the program signal is bypassed to PROGRAM LINE OUT.

14 VITS INSERTION — Cover plate with a table showing the factory programming of the VIT signals. The cover plate may be removed, leaving a blank programming panel to label any changes in the VITS programming.

15 VIRS Lamps — Three lamps indicate status of the VIR signal.

INCOMING — A green lamp indicates that the VIRS is present on the incoming composite video signal.

DELETE — A red lamp indicates that any incoming signal on the line programmed for VIRS is being deleted.

INSERT — A yellow lamp indicates that an internally generated VIRS is being inserted on the line programmed for VIRS.

16 NOISE AND PEDESTAL (147 only) — Consists of two level switches, two rotary switches, and one variable control to select conditions of the NOISE signal.

17 NOISE — Two-position lever switch to select mode.

DELETION (FULL LINE) — This position deletes any signal on the NOISE VITS lines and inserts a pedestal. When the FULL FIELD SIG Selector switch is in NOISE position, and the PROGRAM/PREVIEW/AUXILIARY switch is in PREVIEW position, the full field signal at the PREVIEW MONITOR OUTPUTS will be deleted and a pedestal inserted.

INSERTION (HALF LINE) — This position deletes noise during the center half of the NOISE VITS lines, and half of the full field signal on the PREVIEW MONITOR OUTPUTS if PREVIEW and NOISE are selected. Noise and pedestal, as selected by the NOISE LEVEL dB, PEDESTAL (IRE) and VAR controls, is inserted in the space deleted.

18 PEDESTAL (IRE) — Selects one of three pedestal levels; 10, 50, or 100 IRE.

19 VAR — Potentiometer controls the change in the pedestal level of at least ±10 IRE. This permits accurate matching of the pedestal level with the level of the measured signal.

20 NOISE LEVEL dB — Two rotary switches vary the amplitude of the internally generated noise signal from −20 dB to −59 dB. The left-hand switch controls in 10 dB increments, and the right-hand switch controls in 1 dB increments.

21 NOISE OUT Connector — This output contains only the NOISE signal. It does not have comp sync, blanking, or pedestal. A 4.2 MHz low-pass filter should be used in series with this output.

22 FULL FIELD SIG — Consists of two rotary switches and one lever switch to select the type of test signal available at the OUT (or rear-panel FULL FIELD TEST SIGNAL) connector and to select the type of control over the FLAT FIELD signal.

23 FULL FIELD SIG OUT — The front-panel connector for the full field test signals.

24 FULL FIELD SIG Selector — Eight-position rotary switch to select one of the following test signals: MULTIBURST, LINEARITY, COMPOSITE, SIN^2 PULSE & BAR, WINDOW, FIELD SQ WAVE, FLAT FIELD, and either NOISE (147A only), or COLOR TEST SIGNAL (149A only).

25 FULL FIELD SIG Mode — Two-position rotary switch (concentric with FULL FIELD SIG Selector switch) to select Full Field mode.

- NORMAL — In this position, the selected full field signal is available on each active line.
- ALT APL — In this position, the full field signal occurs every fifth line, followed by four lines of FLAT FIELD.

26 APL — Two-position level switch to control APL of the FLAT FIELD signal.

- BOUNCE 10-90 — In this position, the APL will automatically bounce between 10 IRE and 90 IRE at a repetition rate determined by the RATE control.

27 RATE — Screwdriver adjustment sets the repetition rate of bounce from 1 second to about 15 seconds.

- VARIABLE — In this position, the level of the active portion of the line is selectable as determined by the VARIABLE APL switch.

28 VARIABLE APL — Rotary switch selects one of eleven APL's at 10 IRE increments from 0 to 100 IRE. 50% APL is repeated between the 0% and 100% APL's to provide a quick change from 0% to 50% to 100%. This is useful for determining APL dependent distortions.

29 MULTIBURST AMPLITUDE — Two-position lever switch to select peak-to-peak amplitude of the MULTIBURST signal.

- NORMAL — In this position, the multiburst amplitude is 90 IRE peak-to-peak, centered at the 55 IRE level.
- REDUCED — In this position, the multiburst amplitude is 60 IRE peak-to-peak, centered at the 40 IRE level.

30 LINEARITY — Consists of two lever switches to control the LINEARITY test signal.

- 5 STEP/ 10 STEP/ RAMP — Three-position lever switch to select type of LINEARITY test signal.
- 5 STEP — LINEARITY signal consists of the 5 step staircase.
- 10 STEP — LINEARITY signal consists of the 10 step staircase.
- RAMP — LINEARITY signal consists of the RAMP signal.

31 LINEARITY SUB-CARRIER

ON — This position adds 40 IRE peak-to-peak of 180° subcarrier to the selected LINEARITY signal.

OFF — This position disables the LINEARITY subcarrier.

32 COLOR TEST SIGNAL (149A only) — Consists of two lever switches to control the signal at the FULL FIELD SIG output when the FULL FIELD Selector is in the COLOR TEST SIGNAL position.

33 COLOR TEST SIGNAL Field Timing — This switch controls the field timing of the chrominance portion of the COLOR BAR signal.

SPLIT FIELD — This position enables chrominance only during lines 66 through 216 of the Full Field signal.

FULL FIELD — This position enables both chrominance and luminance during the entire field of active lines.

34 COLOR TEST SIGNAL Selector — This switch selects either COLOR BARS, MODULATED PEDESTAL, or 50 IRE PEDESTAL.

COLOR BARS — In this position, color bars in accordance with FCC Rules and Regulations §73.699 are provided.

MODULATED PEDESTAL — In this position, three levels of color subcarrier superimposed on a luminance pedestal are provided. The test signal is in accordance with STOC (Satellite Technical and Operational Committee) Test Signal No. 2.

50 IRE PEDESTAL — In this position, all active lines are at 50 IRE.

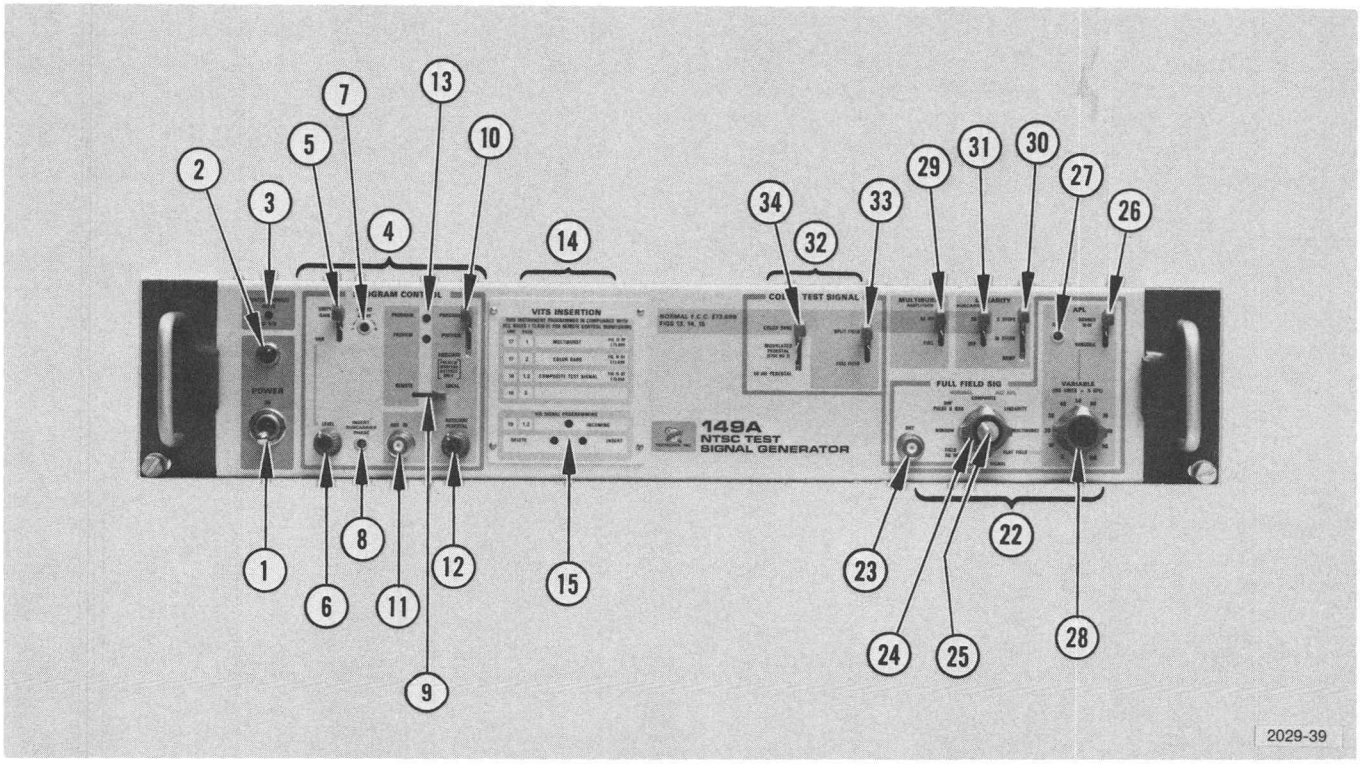


Fig. 1-7. 149A front-panel controls and connectors.

Rear-Panel

35 Power Connector — Twist-lock type of power connector with built-in RF filter.

36 Voltage and Range SELECTOR — Allows programming the power supply input to accept a wide range of input voltages. Ranges are LO, M, and HI for either the 115 V or 230 V source.

37 REMOTE Connector — J9014. Allows remote control operation of some features of the 147A or 149A if desired. See Figs. 1-3 and 1-4.

38 SPARE Connectors — These connectors are included for use with any modifications the user may wish to add.

39 EXT VITS IN — The input connector for a signal with desired VITS when the VITS and FF logic board is programmed for EXT VITS. (External sync and burst must be turned off when the instrument is in the AUXILIARY mode.)

40 PROGRAM LINE IN — The normal input for a program signal or composite video from an external source.

41 COMPOSITE VIDEO (BLACK BURST) — A high-impedance loop-thru connection that is not usually connected. It can be switched into via the REMOTE connector. When switched in, the instrument will lock to the signal applied to this input, rather than the signal applied to the PROGRAM LINE IN.

42 PROGRAM LINE OUT — Program output signal with VITS controlled by the PROGRAM CONTROL switches. Connected to PROGRAM LINE IN through a relay in the BYPASS and POWER OFF conditions.

43 PROGRAM MONITOR OUT — This output has the same signals as the PROGRAM LINE OUT; except, in the BYPASS and AUXILIARY modes, there is no signal output.

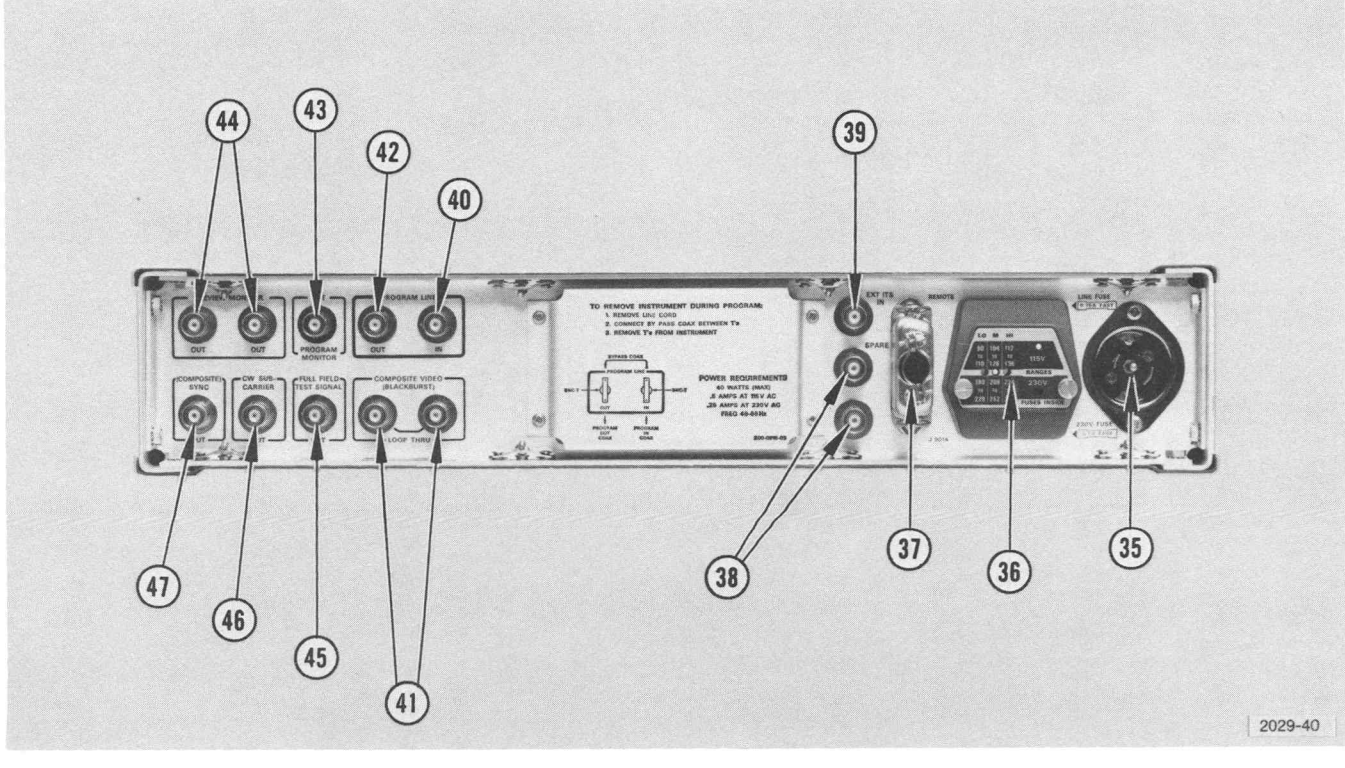


Fig. 1-8. 147A and 149A rear-panel controls and connectors.

44	PREVIEW MONITOR OUT	This output always has VITS added, allowing VITS to be viewed before inserting into the program line. Also, full field noise measurements (147A only) and the AUXILIARY function are available at this output.
45	FULL FIELD TEST SIGNAL OUT	The rear-panel output connector for the full field test signals.
46	CW SUB-CARRIER OUT	Regenerated subcarrier signal, approximately 2 volts peak-to-peak into 75 Ω.
47	COMPOSITE SYNC OUT	Regenerated sync signal, approximately 4 volts negative into 75 Ω.

FIRST-TIME OPERATION

General

The following is primarily intended to familiarize operating personnnel with the operation of the 147A and 149A. It consists of a step-by-step procedure which makes use of each front- and rear-panel control and connector. This procedure will, in most cases, simulate the actual in-service operation of the instrument.

The procedure makes use of a waveform monitor to observe field and line rate displays and a vectorscope to observe phase characteristics. An external video source is needed to provide program material (composite video) and an external VIT signal. The following equipment is used: Tektronix 140 NTSC Test Signal Generator, used as an external video and VIT signal source; Tektronix 1480-Series Waveform Monitor, used to observe field and line rate displays; Tektronix 520A NTSC Vectorscope, used to observe phase characteristics. Proper operation of each unit is assumed; refer to the individual operating instructions for each.

The procedure requires the use of seven (7), 75 Ω BNC coaxial cables (Tektronix Part No. 012-0074-00), four (4), 75 Ω end-line terminations (Tektronix Part No. 011-0102-00), and one (1) 75 Ω feed-thru termination (Tektronix Part No. 011-0103-02, supplied as a standard accessory with 147A and 149A). A small blade screwdriver (XceLite R3323 or equivalent) is also required.

Unless stated otherwise, all 147A and 149A front- and rear-panel controls and connectors referred to will be in upper-case letters (e.g., LINEARITY SUBCARRIER), and all controls and connectors of the associated equipment will be initial upper-case letters only (e.g., waveform monitor A Input).

The procedure is arranged in a sequence that depends upon previous control settings and connections, and should be performed in sequence. There are, however, certain places where all equipment is disconnected, allowing an operator to start the procedure at this point if desired.

NOTE

The following procedure uses the equipment listed. If substitute equipment is used, control settings and/or connections may need to be altered.

Procedure

1. Remove the REMOTE plug, P9014, from the rear-panel REMOTE connector, J9014. (See INSTALLATION; Local-Remote Connector, in this section for details.)

2. Set the 147A or 149A front-panel controls as follows:

PROGRAM CONTROL

UNITY GAIN/VAR	UNITY GAIN
PROGRAM/PREVIEW/ AUXILIARY	PROGRAM
LOCAL/REMOTE	LOCAL

NOISE AND PEDESTAL (147A only)

NOISE	DELETION
PEDESTAL	100 IRE
NOISE LEVEL dB	OFF, 0

COLOR TEST SIGNAL (149A only)

Selector	COLOR BARS
Field Timing	SPLIT FIELD

MULTIBURST AMPLITUDE NORMAL

LINEARITY

SUBCARRIER	ON
Mode	5 STEP

FULL FIELD SIG

Selector	LINEARITY
APL	BOUNCE 10-90
VARIABLE	0
Mode	NORM
POWER	OFF

3. Check for correct positioning of the 147A or 149A rear-panel Range and Voltage Selector. (See INSTALLATION; Operating Voltage, in this section for details.) These must be in agreement for the power source to be used. Connect the 147A or 149A to the power source via the three-connector power cord supplied.

4. Set the POWER switch ON. Note that the green power-on indicator lamp is lit, to indicate that power is being supplied to the instrument; note that the red NONSYNCHRONOUS MODE — NO VITS lamp is lit, indicating lack of Gen-Lock.

NOTE

Without Gen-Lock, the 147A or 149A will not delete or insert VITS.

5. From the 147A or 149A FULL FIELD SIG OUT connector, connect a 75 Ω cable to the waveform monitor A Input connector. Terminate the loop-thru A Input with a 75 Ω end-line termination.

6. Observing the waveform monitor at a 2 Field display rate, note that comp sync is the only signal being generated.

7. Connect the REMOTE plug, P9014, to the rear-panel REMOTE connector, J9014.

8. Observing the waveform monitor, note that Full Field signals are being generated by the 147A or 149A. Observe the display at a 10 μs/div display rate. The display should be the 5 Step LINEARITY test signal, similar to that shown on Fig. 1-9 of this manual.

NOTE

Without proper connection to the REMOTE connector, Full Field signals will not be generated.

9. Switch the 147A or 149A LINEARITY controls. The display will be either the 5 Step, 10 Step, or Ramp LINEARITY signal (according to the LINEARITY switch), with or without modulation as determined by the setting of the SUBCARRIER switch. Return the LINEARITY switches to produce the 5 Step, with modulation, LINEARITY signal.

10. Set the FULL FIELD SIG Selector switch to FLAT FIELD. Observing the waveform monitor display for several seconds, notice that the display consists of sync and a square wave. The square wave should automatically bounce between 10 and 90 IRE. Using a small screwdriver, rotate the front-panel RATE control fully counterclockwise. Note that the time now required for the square wave to bounce between 10 and 90 IRE is slow (approximately 15 seconds). Turn the RATE control fully clockwise. The rate of bounce should have increased (approximately 1 second). Set the RATE control as desired.

11. Set the APL switch to VARIABLE. The display will consist of sync only. Observing the display, rotate the VARIABLE switch to 10, then 20. Notice that the square wave increases in amplitude as the VARIABLE is increased. This control allows the operator to select any APL level desired in 10 IRE increments between 0 and 100 IRE. Notice the (50) position of this switch between 0 and 100. As a convenience to the operator, this position allows standard 10-50-90 APL measurements to be made without completely rotating the switch 360°. Observe the display at a 2 Field display rate. The FLAT FIELD signal should occupy all active video lines. Set the waveform monitor for a 10 μs/div display rate; set the 147A or 149A VARIABLE switch to 50 IRE.

12. Set the 147A or 149A FULL FIELD SIG selector switch to FIELD SQ WAVE. Notice that the display is similar to the FLAT FIELD signal, except the square wave is at 100 IRE at all times. Observe the display at a 2 Field display rate. Notice that the square wave does not occupy all active video lines. Only lines 57 through 227 of each field are used. Set the waveform monitor for a 10 μs/div display.

13. Set the 147A or 149A FULL FIELD SIG selector switch to WINDOW. This signal will be similar to that shown in Fig. 1-9 of this manual. It consists of 2T pulse,

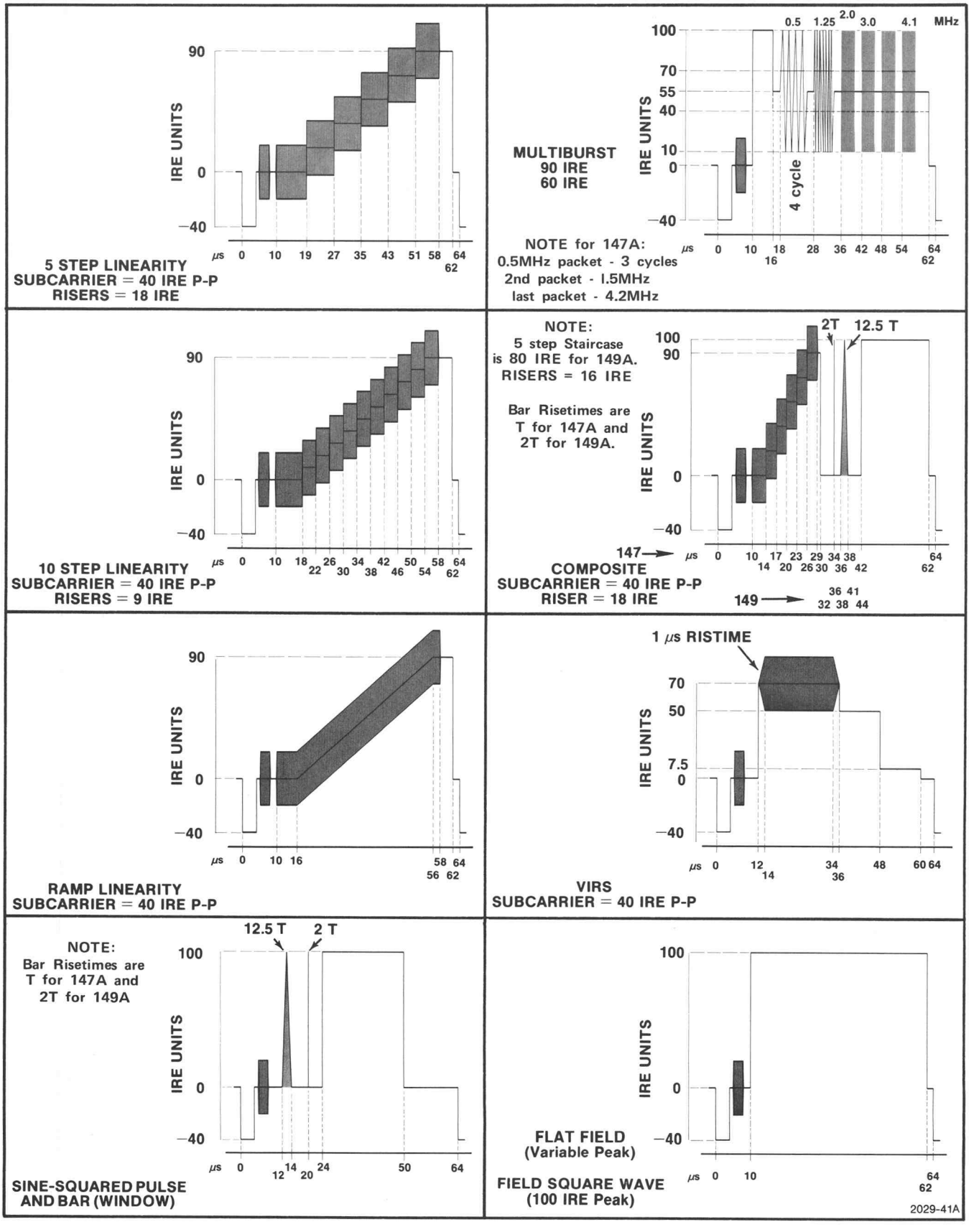


Fig. 1-9. Test signal output timing details.

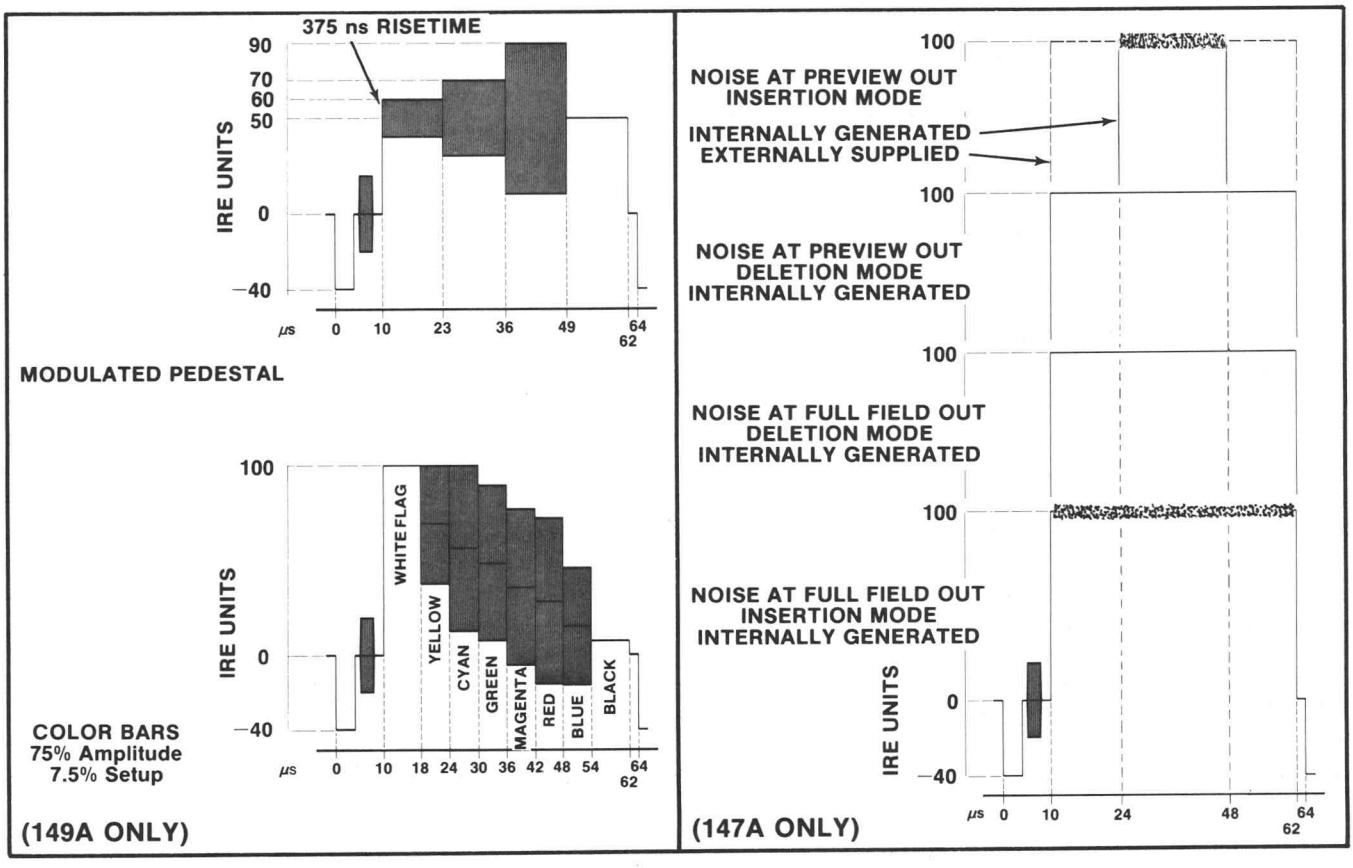


Fig. 1-9. (Cont.) Test signal output timing details.

modulated 12.5T pulses, and a Bar. Observe the display at a 2 Field display rate. Notice the 2T and modulated 12.5T pulses occur each active line of both fields, but the Bar occurs only part of the time. The Bar portion of this signal occupies lines 66 through 218 of each field. Set the waveform monitor for a 10 μs/div display.

14. Set the 147A or 149A FULL FIELD SIG selector switch to SIN^2 PULSE AND BAR. This signal should be similar to the WINDOW signal observed in step 13. Observe the display at a 2 Field display rate. Notice that the Bar occupies all active video lines. This is the only difference between SIN^2 PULSE AND BAR and the WINDOW signal. Set the waveform monitor for a 10 μs/div display.

15. Set the 147A or 149A FULL FIELD SIG selector switch to COMPOSITE. The display should be similar to that shown in Fig. 1-9 of this manual. It consists of the 5 Step Staircase (LINEARITY) and the SIN^2 PULSE AND BAR signal. Only the line timing has been changed on these signals. Switch the LINEARITY controls. Notice the 5 Step Staircase cannot be changed, but the modulation on the steps corresponds to the setting of the SUB-CARRIER switch. Return the LINEARITY switches to 5 STEPS and SUBCARRIER ON.

16. Set the 147A or 149A FULL FIELD SIG selector switch to MULTIBURST. This signal should be similar to that shown in Fig. 1-9 of this manual. The signal occupies all active video lines of both fields. Set the MULTIBURST AMPLITUDE switch to REDUCED. Notice the reduced peak-to-peak amplitude of each burst packet and the level about which the burst packets are centered. The white level should remain at 100 IRE. Return the MULTIBURST AMPLITUDE switch to NORMAL.

17. (149A only.) Set the FULL FIELD SIG selector switch to COLOR TEST SIGNAL. This signal is controlled by the COLOR TEST SIGNAL switches. Set the waveform monitor for a 2 Field display rate. The first and last portions of the field do not contain chrominance information. Turn the COLOR TEST SIGNAL Field Timing switch to FULL FIELD. The signal will have chrominance on during the entire field. Set the waveform monitor to 10 μs/div display rate. The COLOR BARS signal will be displayed. Return the Field Timing switch to SPLIT FIELD. The luminance portion of the COLOR BARS signal can be seen overlaying the chrominance portion. Set the COLOR TEST SIGNAL selector switch to MODULATED PEDESTAL. The signal consists of a 50 IRE luminance pedestal with chrominance modulation levels of 20, 40, and 80 IRE. Set the COLOR TEST SIGNAL selector to 50 IRE PEDESTAL. The chrominance modulation is removed from the 50 IRE pedestal. Return the COLOR TEST SIGNAL selector to COLOR BARS.

18. Set the 147A or 149A FULL FIELD SIG selector switch to LINEARITY, and the mode switch to ALT. The LINEARITY signal will appear overlayed by the 50% APL signal. Set the waveform monitor for a 2 Field display, and Mag to X50. The signal consists of one line of LINEARITY, followed by four lines of the 50% APL signal. Note that the FLAT FIELD controls affect the four-line portion of the signal, and the FULL FIELD SIG selector controls the one-line portion of the signal. Return the mode switch to NORMAL.

19. (147A only.) Set the FULL FIELD SIG selector switch to NOISE. This signal is controlled by the NOISE AND PEDESTAL switches and controls. Set the PEDESTAL (IRE) switch to 50, then 10, and back to 100. Note that the pedestal amplitude corresponds to the setting of this switch. (In the DELETION mode, this is the only switch affecting the signal.) Set the NOISE switch to INSERTION. The display should be similar to that obtained in the DELETION mode. Rotate the VAR control. Note that the pedestal level can be changed approximately ±10 IRE about the level determined by the setting of the PEDESTAL switch. Set the NOISE LEVEL dB OFF/−20 switch to −20. Notice that noise has been added on the pedestal. Rotate the NOISE LEVEL dB 9/0 switch. There should be a decrease in noise level. These two dB switches provide noise attenuation from −20 dB to −59 dB in 1 dB steps. (700 mV RMS = 0 dB.) Set the dB switches to −20 and 0. Rotate the VAR control to center the NOISE about the 100 IRE level.

NOTE

In steps 8 through 19, each FULL FIELD SIG OUT has been demonstrated. These same signals are also available at the rear-panel FULL FIELD TEST SIGNAL OUTPUT.

20. (147A only.) Disconnect the 75 Ω cable from the OUT connector and reconnect it to the NOISE OUT connector. Observing the waveform monitor display, switch the NOISE and PEDESTAL switches. Note that the signal is controlled only by the NOISE LEVEL dB switches and that the signal is continuous (e.g., no line or field sync).

NOTE

In actual use, an in-line 4.2 MHz low-pass filter must be used with the NOISE OUT signal.

21. Disconnect the 75 Ω cable from the NOISE OUT (if 147A) connector or from the OUT connector (if 149A) and reconnect it to the rear-panel COMPOSITE SYNC connector. There should be no display, as the 147A or 149A must be Gen-Locked to provide composite sync to this connector.

22. Disconnect the 75 Ω cable from the rear-panel COMPOSITE SYNC connector and reconnect it to the CW SUBCARRIER OUT connector. Disconnect the 75 Ω cable from the waveform monitor A Input and connect it to the Vectorscope CH A Input connector; terminate the other CH A loop-thru connector with a 75 Ω end-line termination. There should be no vector display, as the 147A or 149A must be Gen-Locked to provide CW to this connector.

23. Disconnect all connections.

NOTE

In the steps to follow, this procedure will, where possible, simulate the actual in-service operation of the 147A or 149A.

24. Using 75 Ω cables and 75 Ω end-line terminations, make the following connections:

a. 147A or 149A PROGRAM LINE OUT to waveform monitor A Input; waveform monitor A Input loop-thru to Vectorscope CH A connector; terminate Vectorscope CH A loop-thru connector into 75 Ω.

b. 147A or 149A PREVIEW MONITOR OUT to waveform monitor B Input; waveform monitor B Input loop-thru to Vectorscope CH B connector; terminate Vectorscope CH B loop-thru connector into 75 Ω.

c. 140 NTSC Test Signal Generator (external video source) Subcarrier to Vectorscope Ext CW Ø Ref connector; terminate Vectorscope Ext CW Ø Ref loop-thru into 75 Ω.

d. 140 (external video source) Comp Sync to waveform monitor Ext Neg Sync Input; waveform monitor Ext Neg Sync Input loop-thru to Vectorscope Ext Sync J120 connector; terminate Vectorscope Ext Sync J121 connector into 75 Ω.

e. 140 (external video source) Comp Video to 147A or 149A PROGRAM LINE IN connector.

25. Set the 147A or 149A controls and switches as given in step 2, except set the POWER switch ON and the PROGRAM CONTROL PROGRAM/PREVIEW/AUXILIARY switch to PREVIEW. Set the Vectorscope to view the CH A Input in a vector mode, using external sync and Ø Reference. Set the waveform monitor to view the A Input at a 10 μs/div display rate, using external sync with line 19 of field one (1) selected. Set the external video source (140) to provide Full Field color bars with a color bar VIT signal on line 19.

26. Observe the 147A or 149A front-panel. The NON-SYNCHRONOUS MODE/NO VITS lamp should be extinguished. This indicates that the 147A or 149A has been Gen-Locked with the external video, and is capable of deleting and inserting internally-generated VITS.

27. Notice that the 147A or 149A front-panel PREVIEW lamp is lit to indicate status (lamp extinguished indicates relay not energized). In this mode of operation, program video to the PROGRAM LINE IN is being passed to the PROGRAM LINE OUT without interruption as indicated by the waveform monitor and Vectorscope displays. Observe the waveform monitor at 10 μs/div display rate with the Dig (digital) button pushed, and line 20 selected. The external color bar VIT signal should be on line 19 of field one (1).

28. Observe the waveform monitor B Input (PREVIEW MONITOR). VIRS should be present on line 19 of field one (1). This signal is similar to that shown in Fig. 1-9 of this manual. Also, note that the 147A or 149A front-panel VIRS INCOMING lamp is extinguished and (2) the VIRS INSERT and VIRS DELETE lamps are lit. This indicates (1) the external video source does not contain a VIRS, and (2) if the external video source contains a VIT signal on the line programmed for VIRS, it will be deleted and replaced by the internally-generated VIRS.

NOTE

The signal appearing at the PREVIEW MONITOR OUTPUT allows operating personnel to observe the actual signal after insertion without actually going to an 'on the air' mode of operation.

29. Using the waveform monitor digital line selector, check that all VIT signals, as factory programmed, are being inserted on the proper line and field, according to Tables 1-2 or 1-3.

TABLE 1-2

147A FACTOR VITS PROGRAMMING

LINE	FIELD	SIGNAL
17	1	MULTIBURST
17	2	NOISE[3]
18	1	COMPOSITE
18	2	LINEARITY
19	1 & 2	VIRS

[3]**NOISE will be displayed in the center half of line 17 only, and will be dealt with later in the procedure.**

TABLE 1-3

149A FACTORY VITS PROGRAMMING

LINE	FIELD	SIGNAL
17	1	MULTIBURST
17	2	COLOR TEST SIGNAL
18	1 & 2	COMPOSITE
19	1 & 2	VIRS

30. Set the 147A or 149A PROGRAM CONTROL PROGRAM/PREVEIW/AUXILIARY switch to PROGRAM. Observing the waveform monitor A Input (PROGRAM

LINE OUT), notice that the internally-generated VIT signals have been applied to the 'on the air' signal. Note that the 147A or 149A front-panel PROGRAM CONTROL PROGRAM lamp is lit to indicate status.

31. Set the waveform monitor to view line 19 of field 1. Observing the display, set the 147A or 149A POWER switch to OFF. Notice that the color bar VIT signal has returned. This indicates that external video has bypassed the 147A or 149A, and demonstrates the fail-safe characteristic of the instrument should loss of power, sync, etc., occur during an 'on the air' (PROGRAM) situation. Return the 147A or 149A POWER switch to ON.

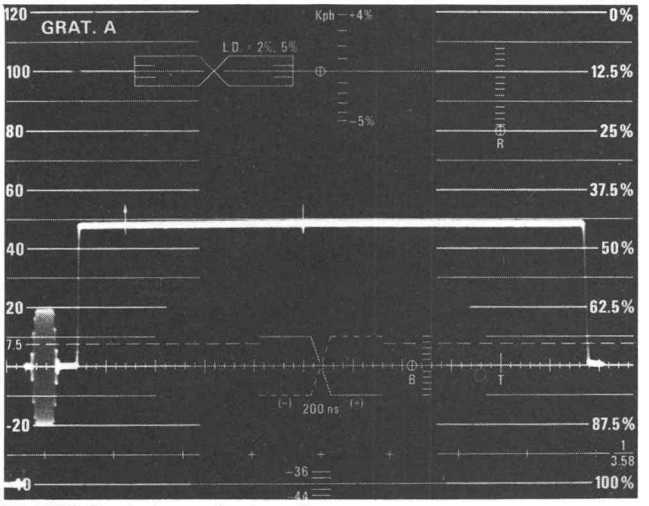
32. (147A only). Set the waveform monitor to observe line 17 of field two (2), using the A Input (PROGRAM MONITOR). Set the external video source to provide a 50% APL VIT signal on line 17 of field two (2). (If using the Tektronix 140, set the Mod Staircase 0° Subcarrier and Steps switches down and the APL switch to 50; this will produce the 50% APL signal). Set the 147A controls as follows: PROGRAM CONTROL PROGRAM/ PREVIEW/AUXILIARY to PREVIEW; NOISE to INSERTION; PEDESTAL to 100; NOISE LEVEL dB to −20 and 0; FULL FIELD SIG selector to NOISE. The display should be similar to that shown in Fig. 1-10A. Next, set the waveform monitor to view the B Input (PREVIEW MONITOR). The display should appear similar to that shown in Fig. 1-10B. Change the NOISE and PEDESTAL switches and control; their effect should be as demonstrated using the Full Field signal. This signal allows 'on the air' noise measurements to be made during the vertical interval, by deleting the center portion of the external VIT signal and inserting internal noise which is of known amplitude for comparison purposes.

33. (147A only). Set the waveform monitor for a 10 μs/div display rate with the Line Selector Off. Notice that each active video line contains the external video signal with interruptions for noise. Set the 147A FULL FIELD SIG selector switch to any position other than NOISE. Each active line should contain only the external video. Return the FULL FIELD SIG selector switch to NOISE.

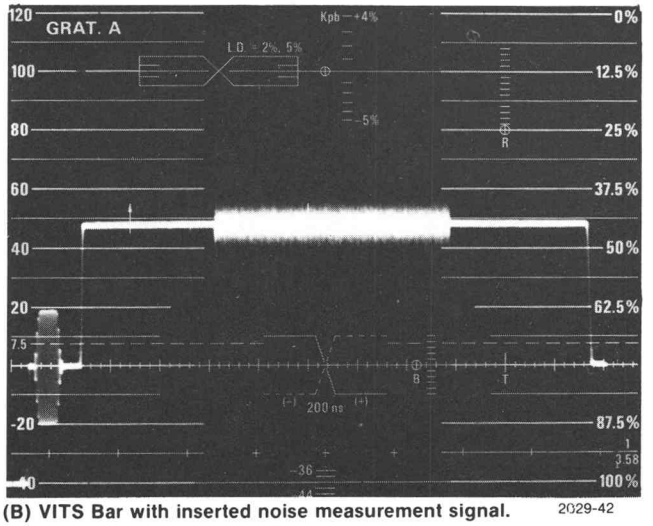
NOTE

The signal appearing at the PREVIEW MONITOR OUTPUT is available in the PREVIEW mode only.

34. (147A only). Set the 147A PROGRAM CONTROL PROGRAM/PREVIEW/AUXILIARY switch to PROGRAM, and the waveform monitor to display the A Input (PROGRAM LINE OUT). The display should contain only the external video. Push the Dig button. Again, the display should appear similar to that shown in Fig. 1-10B.



(A) VITS Bar before noise insertion.



(B) VITS Bar with inserted noise measurement signal. 2029-42

Fig. 1-10. Typical waveform monitor displays of (A) 50 IRE VIT Signal without noise, and (B) 50 IRE VIT Signal with noise measurement signal inserted.

35. Observing the waveform monitor A Input at a 2 Field display rate and the Vectorscope CH A Input vectors (both are PROGRAM LINE OUTPUTS), set the 147A or 149A PROGRAM CONTROL UNITY GAIN/VAR switch to VAR and rotate the LEVEL control. The amplitude of the external video can now be varied with the LEVEL control. Observe the waveform monitor display of the vertical interval with X25 magnification. Rotation of the LEVEL control should not affect internally-generated VITS. Turn off the waveform monitor magnification and adjust the LEVEL control for a signal amplitude of 140 IRE peak-to-peak. (The LEVEL control allows the operator to match incoming program material to the internally-generated signals). Return the PROGRAM CONTROL to UNITY GAIN.

36. Observing the Vectorscope display, use a small screwdriver and rotate the 147A or 149A PROGRAM CONTROL INSERT SUBCARRIER PHASE control. There should be a vector representing internally-generated subcarrier which is controlled by rotation of this control. Superimpose this vector on the vector representing external subcarrier. The INSERT SUBCARRIER PHASE control enables the operator to match the phase of the internally-generated subcarrier to the phase of the external subcarrier.

37. Connect the unused Comp Video output from the 140 to the EXT VITS IN connector. Set the 147A or 149A PROGRAM CONTROL PROGRAM/PREVIEW/AUXILIARY switch to AUXILIARY and view the waveform monitor B Input (PREVIEW MONITOR) at a 10 μs/div display rate. Sync and burst will be double amplitude. As explained under Controls and Connectors, when in AUXILIARY mode of operation with an external VITS applied to the EXT VITS IN connector, there must be no sync or burst added with the external VIT signal. Disconnect the 75 Ω cable from the EXT VITS IN connector. Sync and burst should now be normal amplitude.

38. Observing the waveform monitor display, rotate the 147A or 149A PROGRAM CONTROL AUXILIARY PEDESTAL control. The peak amplitude of the displayed square wave (pedestal) can now be varied between 0 and 100 IRE. Disconnect the 75 Ω cable from the rear-panel PREVIEW MONITOR OUTPUT and reconnect it to the PROGRAM MONITOR OUTPUT connector. There is no signal from the PROGRAM MONITOR OUTPUT in this mode. Observing the waveform monitor A Input (PROGRAM LINE OUT), notice that external color bars are displayed and rotation of the AUXILIARY PEDESTAL control has no effect. The Auxiliary signal will be only applied to the PREVIEW MONITOR OUTPUT with the PROGRAM LINE IN bypassed through the relay to the PROGRAM LINE OUTPUT. This is the only mode where the PROGRAM MONITOR OUTPUT does not contain the same signal as the PROGRAM LINE OUTPUT. Set the waveform monitor to view the B Input, and reconnect the PREVIEW MONITOR OUTPUT.

39. Apply a color bar signal via a 75 Ω cable to the 147A or 149A AUX IN connector. (If using the Tektronix 140, use the same signal applied to the EXT VITS IN from the Comp Video output). The external applied color bar has been added on the pedestal level of the auxiliary signal. Rotate the AUXILIARY PEDESTAL control. The pedestal on which the external color bar is riding can again be changed between 0 and 100 IRE with rotation of this control. This input, although demonstrated using a color bar, can be driven by any signal desired for a specific application, such as a sweep generator output, etc.

40. Set the 147A or 149A PROGRAM CONTROL REMOTE/LOCAL switch to REMOTE. Note that the PROGRAM CONTROL PREVIEW lamp is lit to indicate status. Observe the waveform monitor, first at a 10 μs/div display rate, then a 2 Field display rate. The display should contain the external video signal with VITS inserted. Switch the PROGRAM CONTROL PROGRAM/PREVIEW/AUXILIARY switch to any position. There should be no change to the displayed output.

NOTE

With the PROGRAM CONTROL REMOTE/LOCAL switch set to REMOTE, control is via the rear-panel REMOTE connector. As factory-connected, the 147A or 149A operates in PREVIEW.

41. Set the 147A or 149A switches and controls as given in step 2 of this procedure, except set the POWER switch ON, and the PROGRAM CONTROL PROGRAM/PREVIEW/AUXILIARY switch to PROGRAM. Ground pin 9 of J9014 to enable the BLACK BURST input. Observing the waveform monitor B Input at a 2 Field display rate, notice that only the external video is being passed by the 147A or 149A. Also, note that the front-panel NONSYNCHRONOUS MODE — NO VITS lamp is lit, indicating lack of Gen-Lock. Under this condition, the 147A or 149A will not insert or delete.

42. Disconnect the external color bar signal from the 147A or 149A AUX IN connector and reconnect it to the rear-panel BLACK BURST input connector; terminate the other BLACK BURST input loop-thru connector into 75 Ω. Set the external sync source to obtain 'Black Burst'. (If using the Tektronix 140, set the Video switch to Off.) The 147A or 149A NONSYNCHRONOUS MODE — NO VITS lamp should be extinguished, and the waveform monitor should be displaying the inserted VITS.

43. Push the waveform monitor Dig Line Selector button and set the monitor to view line 19 of field one (1) of the A Input at a 10 μs/div display rate. The VIRS will be displayed. Using a small blade screwdriver, rotate the 147A or 149A INSERT DELAY control. The position on the line of the VIR signal can be changed, thus allowing the operator to control time-positioning of internally-generated VITS with respect to the incoming signal.

NOTE

The following demonstrates if the 147A or 149A will accept and display an external VIRS. It is not intended that the operator use the instrument in the manner described.

44. Connect a 75 Ω cable between the rear-panel FULL FIELD TEST SIGNAL output connector and the rear-panel PROGRAM LINE IN connector.

45. Notice the 147A or 149A front-panel VIRS INCOMING, VIRS DELETE, and VIRS INSERT lamps; each should be flickering. This merely indicates that the VIRS INCOMING circuits are working properly. If an external VIRS were used, these lights would stay on to indicate VIRS status. (Refer to Operating Options in this section for additional details.)

46. This completes the first-time operation. Disconnect all connections.

GENERAL INFORMATION

Test Signals

The 147A and 149A generate the following test signals:

MULTIBURST. The MULTIBURST signal consists of a white flag (100 IRE) and six packets of sine wave bursts, each at a discrete frequency. This allows an approximation of the frequency response of a system driven by this signal. When measuring frequency response using the MULTIBURST signal, measure the peak-to-peak amplitudes of the individual packets, near their center if possible (see Fig. 1-11). Avoid using the outline of the packets as a frequency response curve, because the center level of the packets might be shifted vertically by distortions in the system being measured.

LINEARITY. The LINEARITY test signals consist of the 5 STEPS, 10 STEPS, and RAMP. These signals are useful in measuring nonlinear distortions such as differential gain, differential phase, and line-time nonlinearity.

Differential-Gain. Differential gain is basically the change in the chrominance signal amplitude as the amplitude of the luminance signal changes between black and white. A picture affected by differential gain shows a change in the saturation of the colors.

The method of measuring differential gain, as recommended by IEEE Method (C), is to measure the difference between the two extremes of the largest amplitude and the smallest amplitude, using the largest amplitude as a reference. The formula for this method is

$$100 \left(1 - \frac{a}{b} \right) \%$$

where (b) is the largest chrominance amplitude, and (a) is the smallest.

To perform the measurement, the luminance signal should be filtered out with a 3.58 MHz bandpass filter which has a bandwidth wide enough to show all of the chrominance packet without appreciable rolloff, say between 500 kHz and 2 MHz. Most waveform monitors have built-in bandpass filters which can be switched in from the front-panel. See Fig. 1-12 for an example of differential gain measured on a waveform monitor or oscilloscope.

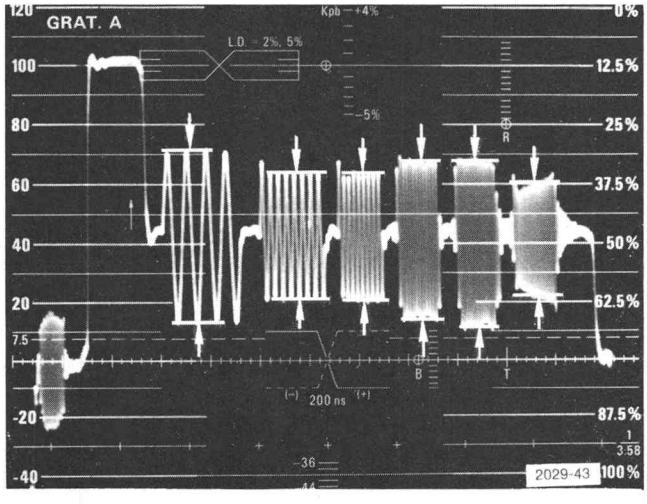


Fig. 1-11. Using the MULTIBURST signal to measure frequency response. Measure peak-to-peak amplitudes at the center of each packet as shown.

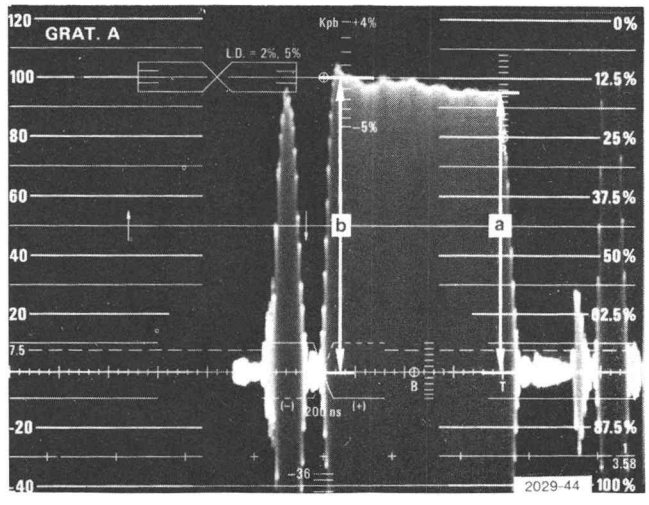


Fig. 1-12. Differential Gain as measured on a waveform monitor, using the COMPOSITE test signal.

The Tektronix 520A Vectorscope has differential phase and gain measurement capabilities. When set up properly, differential gain can be read directly from the graticule of the 520A. To set up the 520A, couple the signal to be measured (LINEARITY test signal) into Channel A, and terminate the loop-through connector in 75 Ω. Push the Ch A, Full Field, Aϕ, and Vector buttons. Set the Channel A switch to Max Gain, and adjust the variable Gain control to place the largest LINEARITY signal vector dot to the outer circle on the Vector graticule. Next, push the Diff Gain button and vertically position the peak of the trace to the 0% Diff Gain graticule line. Read the maximum amount of differential gain on the graticule line corresponding to the smallest portion of the signal or a dip in the trace.

Differential Phase. Differential phase is the change in phase of the chrominance signal as the luminance signal amplitude changes between black and white. This will show up on a picture as a change in the hues of the colors.

The 520A Vectorscope has built-in differential phase measurement capabilities. These include a fairly accurate graticule scale readout, which is quick and easy to use. For more accurate measurements, the 520A has a Calibrated Phase dial. Refer to the 520A Instruction Manual for measurement information.

Line-Time Nonlinearity. Line-time nonlinearity is a difference in gain from the black level to the white level of a video signal. Monochrome signals and the luminance portion of color signals are affected by this distortion.

The 5 STEPS or 10 STEPS staircase signals are usually used to measure the amount of line-time nonlinearity. The output of the circuit being measured is differentiated and fed to an oscilloscope or waveform monitor. An external differentiating network may be used, such as the Tektronix Video Staircase Differentiator, p.n. 015-0154-00. The Tektronix 1480 Waveform Monitor has a Differentiated Step position on the Response switch and doesn't need an external network.

Fig. 1-13 shows the waveforms used in this measurement. The largest spike is the reference amplitude, (b). Adjust the oscilloscope or waveform monitor variable amplitude control for a convenient amplitude of (b), normally 100 IRE units on a waveform monitor graticule. Next, measure the relative amplitude difference of the spike with the greatest amplitude difference from (b). This amplitude will be called (a). Calculate the amount of nonlinearity using the formula:

$$D_{NL} = 100 \left(1 - \frac{a}{b} \right) \%$$

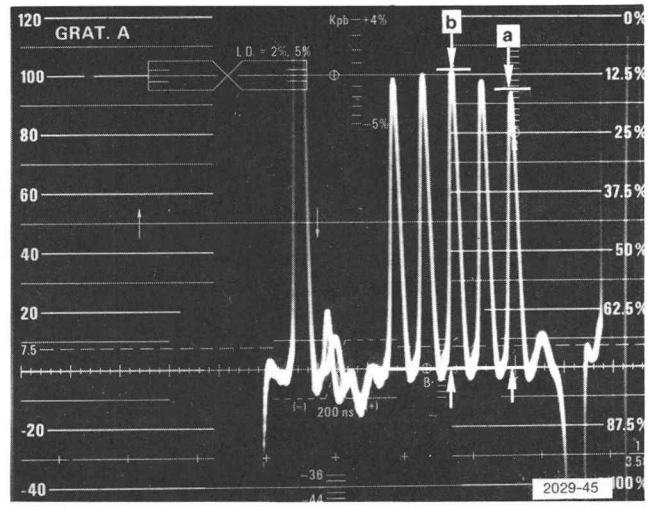


Fig. 1-13. Line Time Nonlinearity as measured on a waveform monitor, using the COMPOSITE test signal.

SIN^2 PULSE & BAR. The components of this signal are the 12.5T Modulated Pulse, the 2T Pulse, and the T Bar. The signal is used to perform a variety of linear distortion measurements. Some of the parameters measured on this signal, and the distortions which can cause a change in these parameters are as follows:

Pulse-to-Bar Ratio — Bandwidth distortion
Pulse ringing — Frequency response
Pulse Rise- and Fall-times — Quadrature distortion
Bar Tilt — Line-time distortion
Modulated Pulse baseline — Chrominance/Luminance delay
Modulated Pulse amplitude — Chrominance/Luminance gain

WINDOW. The WINDOW signal is similiar to the SIN^2 PULSE & BAR signal except that the Bar portion of the signal only occurs during the center part of the field, lines 66 through 217. This allows the signal to be used for field time measurements and short time measurements.

FIELD SQUARE WAVE. The FIELD SQUARE WAVE test signal is used to evaluate field time distortions. The signal consists of a 100 IRE bar occurring on lines 57 through 227 of each field, approximating a 60 Hz square wave. Composite sync and blanking allow this square wave to pass through clamping circuits in the equipment under test.

FLAT FIELD. During the active portion of each field, this signal has a luminance level which is variable from 0 to 100 IRE in 10 IRE increments, or which bounces automatically between 10 and 90 IRE at a repetition rate

variable from about 1 to 10 seconds. It is used to test clamper amplifiers, and systems in general, for APL dependent distortions.

NOISE (147A only). Noise encountered in a television system is usually of the type called "White Noise" or "Flat Noise", which contains equal amounts of energy over a wide frequency spectrum. This noise mixes with the television signal, producing unwanted distortion.

Accurate measurement of noise is important to determine the amount of noise added by each stage of the television system. The 147A measures noise by deleting a portion of the incoming signal and inserting a known amount of noise from the internal noise generator. The amount of noise inserted is controlled by the NOISE LEVEL dB switches. When the inserted noise matches the incoming noise, the amount can be read directly from the NOISE LEVEL dB switch settings. This method is accurate within 2 dB.

In the DELETION mode, the 147A deletes the entire active portion of the line and inserts a pedestal which is free of noise. This pedestal establishes a zero noise reference at that point in the video chain. Another 147A inserted in the video chain at a later point, used in the INSERTION mode can determine the amount of noise generated between the two points.

To measure noise amplitude during the active field; connect the PREVIEW MONITOR OUT to a waveform monitor, set the PROGRAM CONTROL switch to PREVEIW, the FULL FIELD SIG Selector to NOISE, and the NOISE switch to INSERTION (HALF LINE). The center half of the signal on each active line will be deleted, and the internally generated noise will be inserted. Adjust the NOISE LEVEL dB switches until the internally generated noise amplitude matches the signal noise amplitude. Then, just read the total of the two NOISE LEVEL dB switches to see how much noise was inserted. This is the amount of "white noise" or "flat noise" present on the incoming signal.

To measure noise amplitude during the vertical interval, either the PROGRAM LINE OUT or the PREVIEW MONITOR OUT may be used. Perform the measurement as described above for measuring on the full field, except set the waveform monitor to display the VITS line for which the NOISE signal is programmed. Measuring during the vertical interval has the advantage of avoiding a change in the RMS level caused by the active video signal. It also allows measuring noise on an in-service basis, when a full field noise pedestal may not be available.

COLOR BARS (149A only). The 149A generates Color Bars with 75% Amplitude, 100% Saturation, and 7.5% Setup level. These color bars are in compliance with the FCC Rules and Regulations 73.676 (f) for Remote Control Monitoring. The COLOR BARS signal is generally used for checking luminance, hue, and saturation levels. It represents a scene with high brightness and saturation.

SPLIT FIELD COLOR BARS are available as a full field signal. This signal consists of the luminance portion of the COLOR BARS signal on each active line of each field, and the chrominance portion of the COLOR BARS signal only on lines 66 through 218 of each field.

MODULATED PEDESTAL (149A only). This signal consists of three chrominance levels (20, 40, and 80 IRE) superimposed on a 50 IRE pedestal, followed by a 50 IRE pedestal with no modulation. Phase of the chrominance is −90° from burst. Chrominance/luminance cross-modulation can be measured using this signal when demodulated.

COMPOSITE. This signal is composed of the LINEARITY 5 STEP staircase and the SIN^2 PULSE & BAR signals. The horizontal timing has been changed to allow all of the components to be placed on one line. This allows measurement of many linear and nonlinear distortions on only one VITS line if desired.

VIRS. The Vertical Interval Reference Signal (VIRS) consists of a 7.5 IRE pedestal, a 50 IRE pedestal, and a 70 IRE pedestal with 40 IRE of chrominance modulation phased at +180° from the B-Y axis. The 70 IRE luminance level with modulation approximates the average program chrominance at typical skin tone luminance. The 50 IRE luminance pedestal represents average scene brightness, and corresponds to the bottom of the chrominance reference, allowing easy comparison to the two levels. The 7.5 IRE luminance pedestal provides a reference for setup.

VERTICAL INTERVAL INSERTION/DELETION. When the digital programmer is Gen-Locked to a program signal, it may delete and re-insert local VITS as determined by the programming.

As the VITS Deleter/Inserter function involves active circuit elements in the programming within the 147A or 149A, fail-safe means are provided in the event of a malfunction within the instrument, such as loss of sync, power, etc.

A PREVIEW function allows the observation of exactly what lines will be deleted and exactly what signals and levels will be inserted on the program line signal before they are inserted on the program signal itself.

Changes in the programming of the several VIT signals are readily done by removing or moving coded jumpers within the 147A or 149A. Any signal may be eliminated or moved.

OPERATING CHANGES

General Information

The 147A and 149A are factory-connected to produce the output signals which are most frequently used by the television industry. However, the 147A and 149A are versatile, in that many internal changes can be made which alter these signals to meet certain applications. For example, the COMPOSITE signal (both Full Field and VITS) as shipped from the factory generates and displays the 5 Step Staircase as a portion of the total signal. This may be internally changed to provide the Ramp signal (in place of the staircase) on the COMPOSITE signal.

NOTE

Some of the changes or modifications that follow require internal adjustment to comply with industry standards. We recommend that only qualified personnel, thoroughly familiar with calibration procedures and video signals, make these changes.

The following provides the information necessary to change or modify the instrument, where possible.

VITS Line and Field Selection

VITS may be selected to appear on lines 10 through 21 of field one, field two, or both fields. Line and Field Selection is accomplished by selecting various internal quick-change pin connectors on the VITS and FF circuit board. An access door is provided so that VITS selection can be made without removing the top cover from the instrument.

Referring to Fig. 1-14, notice that a rectangular matrix is used to select the line and field for each VIT signal. Two jumper plugs must be used to select the VITS; one for field selection, the other for line selection. To prevent or disable a particular VITS, move the line jumper plug to the OFF position.

Each jumper plug has been assigned a particular color, which are brown, red, orange, yellow, green, and blue respectively. This coding simplifies identifying the various VIT signals, and any same-color jumper plug (except black) on the VITS and FF circuit board will affect only that particular signal.

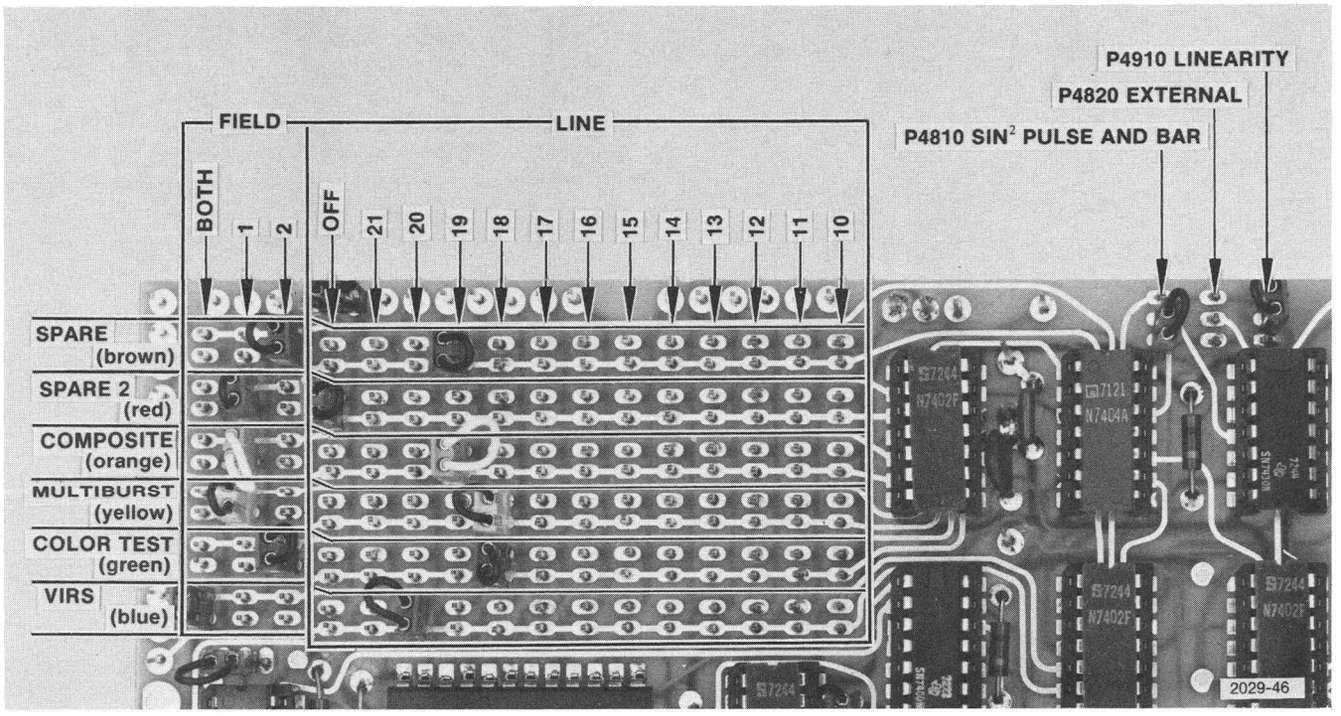


Fig. 1-14. VITS and FF circuit board location of VITS Line and Field selector plugs.

The following information details each VIT signal available.

COLOR TEST SIGNAL (149A), NOISE (147A), MULTIBURST, COMPOSITE, and VIRS: Operating personnel may select any line from 10 throught 21 of field one, field two, or both fields.

SPARE 2: Operating personnel may select any line from 10 through 21 of field one, field two, or both fields for one of the following:

SIN^2 PULSE AND BAR: Pins two (2) and three (3) of P4810 (see Fig. 1-14) must be connected.

LINEARITY: Pins two (2) and three (3) of P4910 must be connected.

EXTERNAL: Pins two (2) and three (3) of P4820 must be connected.

SPARE 1: Operating personnel may select any line from 10 through 21 of field one, field two, or both fields for the SIN^2 PULSE AND BAR, LINEARITY, or EXTERNAL VITS. Selection is accomplished as for SPARE 2, except connections must be made between pins one (1) and two (2) of P4810, P4820, or P4910.

NOTE

To delete an incoming VITS, program for EXTERNAL, and do not put an EXTERNAL VITS into the EXT VITS IN connector.

VITS Cover

As a convenience to the operator, a VITS program cover is supplied with the 147A and 149A with factory-connected VITS written in; see Figs. 1-6 and 1-7 of this manual. This cover can be removed and the front panel will consist of an array of write-in spaces where the internal line and field addresses of the VIT signals may be indicated as programmed by the operator.

Line 21 Deletion/Pass

As factory-connected, any incoming signal on line 21 of either field will be passed. To delete the full active line time of line 21 field one (1), and the first half-line of line 21 field two (2); change the connector on pins one (1) and two (2) of P4200 to pins two (2) and three (3) (see Fig. 1-15).

VIRS Insertion on a Monochrome Program Signal

The 147A and 149A will not normally insert the VIR signal on a monochrome program signal. To insert the VIR signal in the presence of a monochrome program signal, move the jumper on P4779 from pins two (2) and three (3) to pins one (1) and two (2) (see Fig. 1-15).

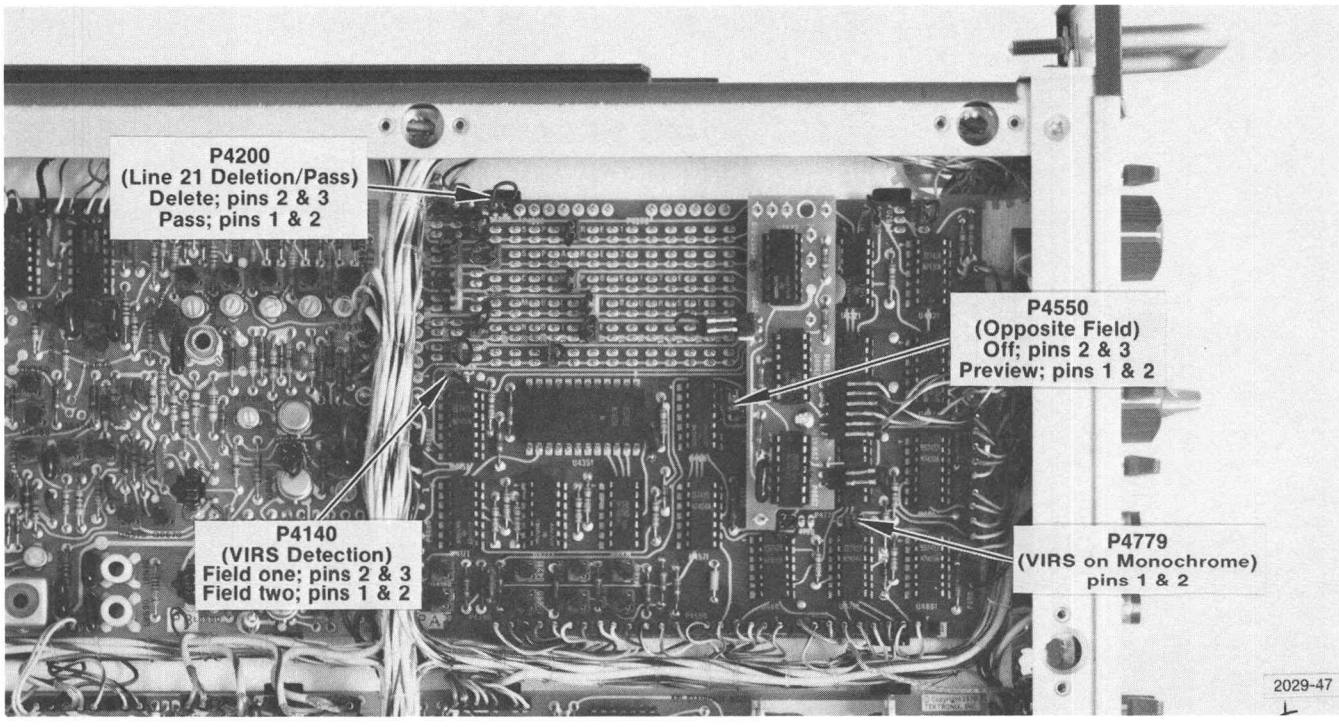


Fig. 1-15. VITS and FF circuit board location of VIRS Detect, Opposite Field Preview, VIRS on Monochrome, and Line 21 Delete plugs.

External VIRS Detection and Opposite Field Preview

The following options have been grouped together because of interaction between them. They are also dependent upon the presence or absence of an external VIRS to the PROGRAM LINE IN, and upon the 147A or 149A internal field programming for VIRS.

The position of the connector on P4140 (see Fig. 1-15) determines which field of the incoming signal is detected for VIRS. Field one detection is obtained by connecting between pins two (2) and three (3). Field two detection is obtained by connecting between pins one (1) and two (2).

The position of the connector on P4550 determines whether internal VIRS will be inserted on the opposite field from external VIRS in the PREVIEW mode of operation. Connecting pins one (1) and two (2) of P4550 allows insertion (PREVIEW); pins two (2) and three (3) connected will not.

Table 1-4 lists the various conditions under which this change is effective.

NOTE

With (1) no external VIRS in, or (2) 147A or 149A programmed for BOTH fields, the Opposite Field Preview is inoperative.

NOTE

With P4550 in OFF (pins 2 and 3), PREVIEW and PROGRAM are the same.

Fig. 1-16 demonstrates a use of the Opposite Field Preview mode. An off-the-air signal has been demodulated and fed to the PROGRAM LINE IN of the generator. The PREVIEW MONITOR OUT is connected to the Tektronix 1480 Waveform Monitor, which has selected Line 19, All Fields. This allows the incoming VIRS on Field one to be overlayed with the internally-generated VIRS on Field two. Fig. 1-16b shows that the incoming VIRS has been restored to an acceptable level by the Tektronix 1440 Automatic Video Corrector.

Horizontal Programming

The 147A and 149A are versatile, in that any signal generated may be internally reprogrammed, using quick-change connectors, to produce signals which are timed according to specific user applications. Fig. 1-9 shows the signals generated by the 147A and 149A, along with all timing information.

Using the COMPOSITE test signal as an example, notice that the horizontal axis has been plotted in microseconds from 0 to 64 (in NTSC, this is actually 63.56 μs, the difference to be explained later) with 10, 14, 17, etc. listed along the axis. Each of these listed times corresponds to a particular portion of the complete signal, which can be reprogrammed as desired. In other words, the 2T pulse might be reprogrammed to start at 32 μs, or completely eliminated.

TABLE 1-4

External VIRS Detection and Opposite Field Preview

VIRS Field Programming		Changes		Program Control			
		VIRS Field Detection (P4140)	Opposite Field Preview (P4550)	PREVIEW MODE; PREVIEW MONITOR DISPLAY of VIRS		PROGRAM MODE; PROGRAM MONITOR DISPLAY of VIRS	
Int	Incoming			Field One	Field Two	Field One	Field Two
1	1	1	PREVIEW	EXT	INT	EXT	NONE
1	1	1	OFF	EXT	NONE	EXT	NONE
2	2	2	PREVIEW	INT	EXT	NONE	EXT
2	2	2	OFF	NONE	EXT	NONE	EXT
1	BOTH	1	PREVIEW	EXT	INT	EXT	EXT
1	BOTH	1	OFF	EXT	EXT	EXT	EXT
1	BOTH	2	PREVIEW	EXT	INT	EXT	EXT
1	BOTH	2	OFF	EXT	EXT	EXT	EXT
2	BOTH	1	PREVIEW	INT	EXT	EXT	EXT
2	BOTH	1	OFF	EXT	EXT	EXT	EXT
2	BOTH	2	PREVIEW	INT	EXT	EXT	EXT
2	BOTH	2	OFF	EXT	EXT	EXT	EXT

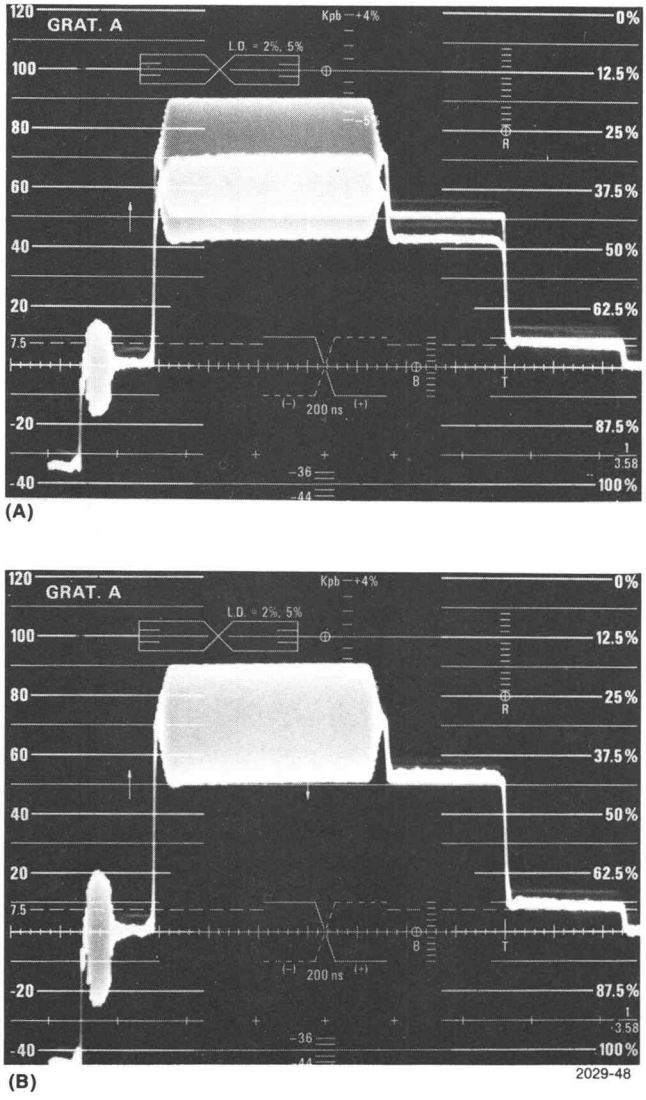


Fig. 1-16. Opposite Field VIRS Preview showing (A) uncorrected overlay of fields one and two, and (B) incoming VIRS corrected by TEKTRONIX 1440 overlaying internal VIRS.

Characteristic Instants

All signal programming is controlled by selection of various gate signals derived by the Horizontal Counter. These gate signals are brought to circuit board square pins for easy access (see Fig. 1-17). There are three groups of pin connectors; Instant, +, and 1/2 Instant. The first group, Instant, is arranged to provide 32 columns with nine rows of pins per column row. These columns are numbered, left to right, 3, 4, ...32, 1, and 2. Each number is a Characteristic Instant and is exactly equal to:

$$\frac{63.56\ \mu s}{32} = 1.98725\ \mu s,$$

or approximately 2 μs. The Characteristic Instant, therefore, represents the time axis of Fig. 1-9, and is the reason for an apparent H Rate of 64 μs.

The second group of pins, + (P2730), contains three (3) pins. This column of pins is used to connect unused inputs. Its use will be explained shortly. The third group of pins, 1/2 Instant (P2950), contains two pins which are internally connected to provide a 1/2 Characteristic Instant (1 μs) timing change. This will also be covered in the example to follow.

Table 1-5 lists the programming as factory-connected. Use of Table 1-5 will be covered in the following example.

NOTE

Reprogramming of some signals may require internal calibration. We recommend that only qualified personnel, thoroughly familiar with the different signal characteristics and calibration procedures, perform these programming changes.

The following example uses the staircase portion of the COMPOSITE signal and involves all three groups of Instants. It is assumed that the staircase portion of this signal has (1) been completely disabled (e.g., all programming wires associated with this signal are disconnected) and (2) the staircase signal will be programmed to provide the same timing as that shown in Fig. 1-9 of this manual.

Proceed as follows:

a. Referring to Table 1-5, scan the Signal, Affected Portion, and Function columns for all possible connections for the staircase portion of the COMPOSITE signal. These are (1) Modulation Set; (2) Modulation Reset; (3) Step Enable Set; (4) Step Enable Reset; (5) 1st Level Set; (6) 2nd and 4th Level Set; (7) 3rd Level Set; and (8) 5th Level Set.

b. Directly opposite the Signal, Affected Portion, and Function columns for each possible connection found in part a, note the Instant Timing column and the Wire and Connector Color Code column. This gives the color code of the wire, color code of the connector connected to the wire, and the instant which corresponds to the time of the signal segment. For connection (3), Steps Enable Set, notice for the wire code a 9-4, for the connector a 0, and for Instant a 4. This indicates that a white wire with a yellow stripe (9-4) and black connector (0) is the only programming wire for the Steps Enable Set circuitry within the instrument. This 9-4/0 combination, when connected to Instant 4 (8 μs) on the Horizontal Timing circuit board, will enable the steps portion of the COMPOSITE signal to be generated.

Using the above connection as a guide, connect the signal segment wires for (1), (4), (5), (7), and (8).

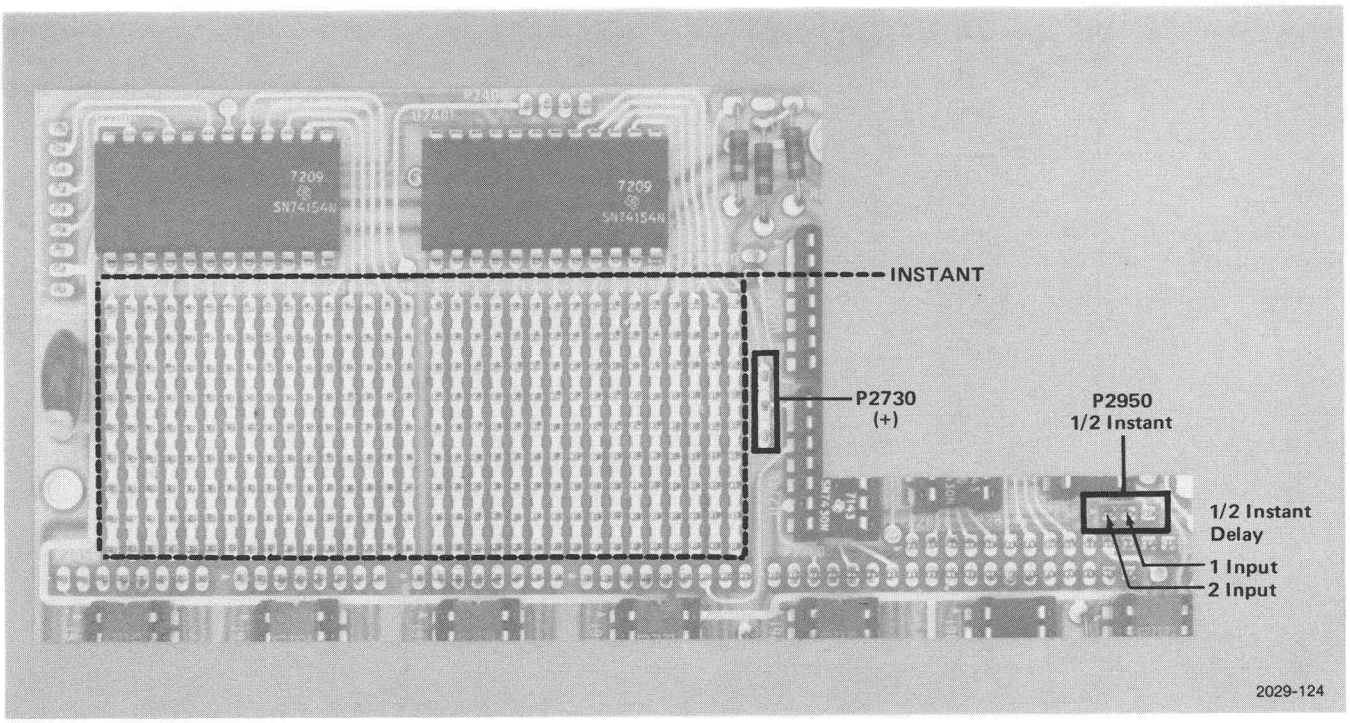


Fig. 1-17. Horizontal Timing circuit board showing location of Characteristic Instants. Use with Table 1-5.

TABLE 1-5
Factory Horizontal Programming

			Timing	Color Code	
Signal	**Affected Portion**	**Function**	**Instant**	**Connector**	**Wire**
All	Horizontal Blanking	Set	5	0	9-5
		Reset	31	0	9-34
Composite	Setup and Phase Sw.	Set	15 (147A)	0	9-07
		Set	16 (149A)	0	9-07
		Reset	31	3	9-34
	Step Modulation	Set	5	2	9-5
		Reset	14[4]	1	9-05
	Step Enable	Set	4	0	9-4
		Reset	15 (147A)	1	9-07
		Reset	16 (149A)	1	9-07
	1st Level	Set	7	0	9-7
	2nd Level	Set	8[4]	3	9-8
	3rd Level	Set	10	0	9-01
	4th Level	Set	11[4]	1	9-02
	5th Level	Set	13	0	9-04
	Pulse	Set	17 (147A)	3	9-12
		Set	18 (149A)	3	9-12
	Modulated Pulse	Set	18 (147A)	0	9-13
		Set	19 (149A)	0	9-13
		Reset	20 (147A)	0	9-15
		Reset	21 (149A)	0	9-15
	Bar	Set	21 (147A)	0	9-16
		Set	22 (149A)	0	9-16
		Reset	31	1	9-34

TABLE 1-5 (cont)

Signal	Affected Portion	Function	Timing	Color Code	
			Instant	Connector	Wire
Linearity	Modulation	Set	5	3	9-5
		Reset	29	0	9-27
	10 Step 1st Level	Set	9	0	9-0
	2nd Level	Set	11	0	9-02
	3rd Level	Set	13	0	9-04
	4th Level	Set	15	0	9-06
	5th Level	Set	17	1	9-08
	6th Level	Set	19	1	9-13
	7th Level	Set	21	0	9-15
	8th Level	Set	23	0	9-17
	9th Level	Set	25	1	9-23
	10th Level	Set	27	2	9-25
	Ramp	Set	8	0	9-8
		Reset	28	0	9-26
Multiburst	White Flag	Set	5	1	9-5
		Reset	8	2	9-8
	Center Level	Set	8	4	9-8
		Reset	31	2	9-34
	Burst Width	Set	1 (149A)	0	9-1
		Reset	17 (149A)	2	9-08
	0.5 MHz	Set	9 (149A)	1	9-0
		Set	11 (147A)	0	9-0
	1.25 MHz (149)	Set	14	0	9-05
		Reset	18	1	9-12
	1.5 MHz (147)	Set	15	1	9-05
		Reset	18	1	9-12
	2.0 MHz	Set	18	2	9-12
		Reset	21	1	9-15
	3.0 MHz	Set	21	2	9-15
		Reset	24	2	9-18
	3.58 MHz	Set	24	0 (149A)	9-18
		Set	24	3 (147A)	
		Reset	27	0	9-25
	4.1/4.2 MHz (149A/147A)	Set	27	1	9-25
		Reset	31	4	9-34
Pulse and Bar	Mod Pulse	Set	6	1	9-6
		Reset	8	1	9-8
	Pulse	Set	10	1	9-01
	Bar	Set	12	0	9-03
		Reset	25	0	9-23
Color Bars (149A only)	White Bar	Clock	5	P2130-3	9-5
	Yellow Bar	Clock	9	P2130-7	9-0
	Cyan Bar	Clock	12	P2130-10	9-03
	Green Bar	Clock	15	P2330-3	9-06

TABLE 1-5 (cont)

Signal	Affected Portion	Function	Timing Instant	Color Code Connector	Color Code Wire
Color Bars (cont)					
	Magenta Bar	Clock	18	P2330-6	9-23
	Red Bar	Clock	21	P2530-3	9-15
	Blue Bar	Clock	24	P2530-6	9-18
	Black Bar	Clock	27	P2630-3	9-25
Modulated	20 IRE Modulation	Set	5	4	9-5
Pedestal	40 IRE Modulation	Set	11[4]	P2130-9	9-02
(149A only)	80 IRE Modulation	Set	18	2	9-23
		Reset	24[4]	3	9-18
(Half Line)	40 IRE Modulation	Set	8	P2130-6	9-8
	80 IRE Modulation	Set	12	0	9-03
		Reset	16	P2330-4	9-07
Noise	1/2 Line Insert	Set	12	0	9-03
(147A only)		Reset	24	0	9-18
VIRS	Modulation	Set	6	0	9-6
		Reset	17	0	9-08
	70 IRE Level	Set	6	2	9-6
		Reset	18	0	9-12
	50 IRE Level	Set	6	4	9-6
		Reset	24	1	9-18
	7.5 IRE Level	Set	6	3	9-6
		Reset	30	0	9-28

[4]**Actual timing of the output signals is delayed 1/2 instant.**

c. For signal segment (2), Modulation Reset, notice the Timing column. A 1/2 Instant (14.5) is being used. This is accomplished by programming to Instant 14, delaying 1 μs, then applying the delayed programming signal to the Steps Modulation Reset circuitry within the 147A or 149A.

Locate the wire and connector combination of 9-05/1 (used with Instant 14) and connect it to Instant 14 (input to 1 μs delay). Now, locate the 9-36/0 combination and connect it to pin 2 of P2950 (output of 1 μs delay). Connections made will add 1/2 Instant or 1 μs to the count, allowing the Steps Modulation to Reset (stop) at 29 μs.

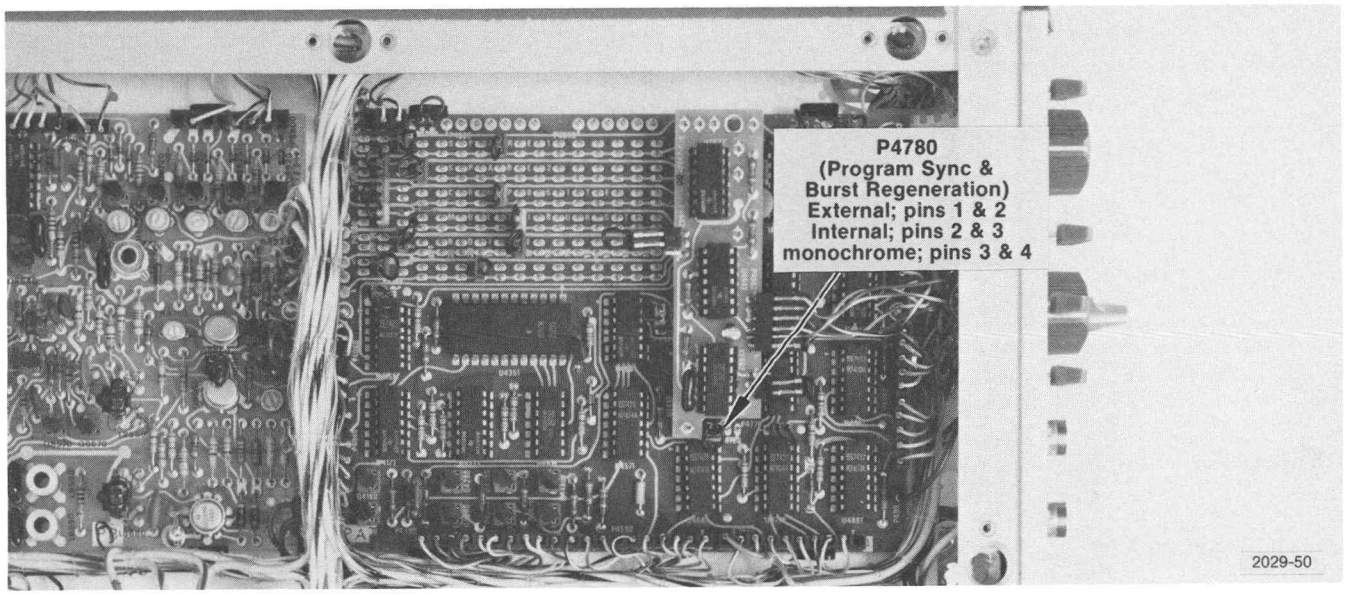


Fig. 1-18. VITS and FF circuit board showing location of the Program Sync and Burst Regeneration plug, P4780.

d. For signal segment (6), notice the Timing column. Two 1/2 Instants (8.5 and 11.5) are given. Locate the 9-8/3 and 9-02/1 combinations and connect them to Instant 14 (2 input to 1 μs delay). Next, locate the 9-37/0 combination and connect it to pin 1 of P2950 (output of 1 μs delay). This will add 1 μs to the second and fourth step starting points, starting them at 17 and 23 μs respectively.

e. Once all the above connections have been made, check that all signal segments appear as shown in Fig. 1-9.

Removing 1/2 Instants

In the above procedure, it was shown how to program in a 1/2 Instant. Now, assume the staircase portion of the COMPOSITE signal was to contain no 1/2 Instants. That is, signal segment (2) was to be programmed to reset at Instant 14 and that signal segments of (6) were to be programmed to Set at Instants 8 and 11.

To Reset at Instant 14 rather than 14.5, disconnect the 9-36/0 combination from pin 2 of P2950 and reconnect it to Instant 14. To start the second step at Instant 8, disconnect the 9-37/0 combination from pin 1 of P2950 and reconnect it to Instant 8. Disconnect the 9-45/0 combination from + (P2730) and connect it to Instant 11.

Deleting Instants

To delete any programming, connect the signal segment programming wire to the + connector (P2730). Connecting any wire to the + will disable that particular function. For example, locate the 9-4/0 combination for the Steps Enable Set, connected in part b of the example, and connect it to the + connector. The staircase portion of the COMPOSITE signal will now be eliminated.

Program Sync and Burst Regeneration

Internally-processed sync and burst (Gen-Locked to the PROGRAM LINE IN signal) can be substituted for the PROGRAM LINE IN sync and burst. To insert internal sync and burst on a color signal, change the connector on P4780 from pins 1 and 2, to pins 2 and 3. This position will not insert sync on a monochrome signal. To insert internal sync and burst on a color signal, and internal sync on a monochrome signal, change the connector on P4780 to pins 3 and 4. See Fig. 1-18 for the location of P4780.

VIT signals on lines 15 and lower of the Program signal will be deleted when internal sync and burst are being inserted. A VIT signal on line 16 or above will be passed when internally-generated VITS are not programmed on the same lines. The front-panel PROGRAM CONTROL/VAR LEVEL adjustment can be used with an incoming VIT signal to set the correct amplitude of the signal with inserted sync and burst. See Fig. 1-19 for an illustration of this.

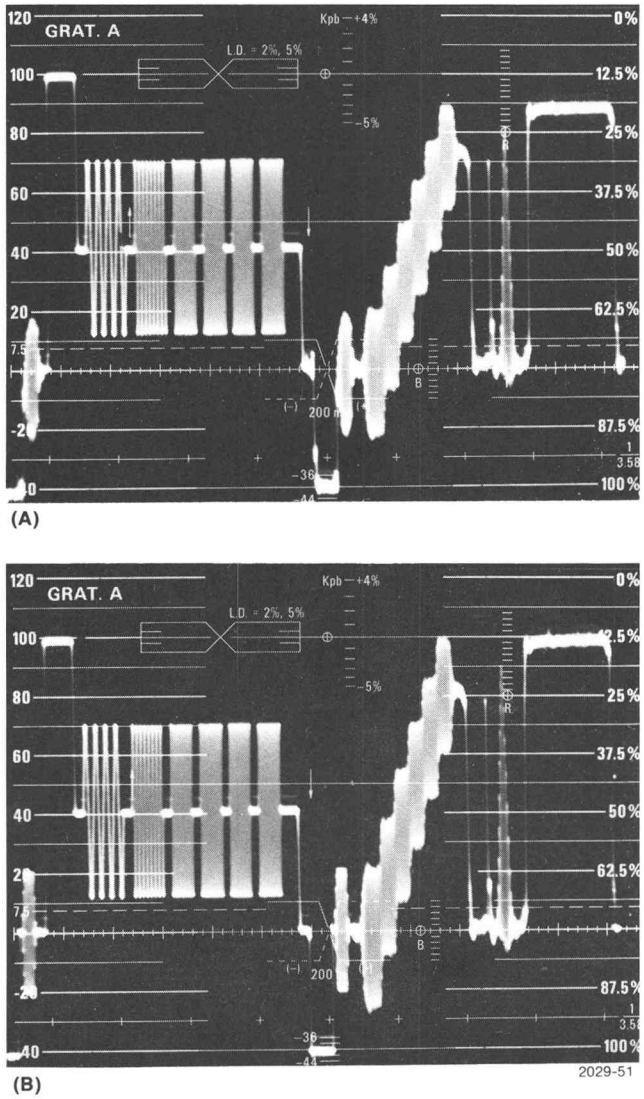


Fig. 1-19. Illustration of Program Sync and Burst Regeneration showing (A) incoming Program signal, and (B) Program signal with sync and burst regenerated, and amplitude adjusted with the VAR LEVEL control.

CW Subcarrier Lock

If desired, the 147A or 149A can be Gen-Locked to a composite sync signal with superimposed subcarrier (such as RCA CompSync) through the BLACK BURST input. This is accomplished by changing the connector on P5141 (see Fig. 1-20) from pins 1 and 2 to pins 2 and 3.

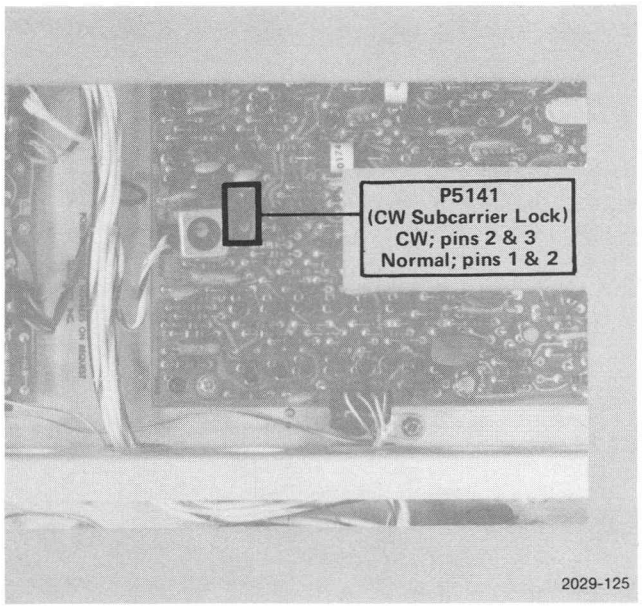


Fig. 1-20. Gen-Lock circuit board location of CW Subcarrier Lock selector plug.

LINEARITY Modulation and Staircase Levels

The following options have been grouped, since there is interaction between them, and depending upon needed signal levels, could require internal calibration.

As shipped from the factory, the LINEARITY test signal modulation amplitude is 40 IRE peak-to-peak. To obtain a modulation amplitude of 20 IRE peak-to-peak, change the connector on pins 2 and 3 of P3400 (see Fig. 1-21) to pins 1 and 2.

To obtain different levels of staircase or ramp, proceed as follows:

5 STEP	Set the LINEARITY switches for 5 STEPS and SUBCARRIER OFF. For a 5 Step amplitude of between 80 and 90 IRE, adjust C3565 (see Fig. 1-21) for the desired amplitude. For a 149A 5 Step amplitude of between 90 and 100 IRE, connect P3470 between pins 2 and 3 (see Fig. 1-21) and adjust C3565 for the desired amplitude. For a 147A 5 Step amplitude between 90 and 100 IRE, connect C3467 to the socket provided, and adjust C3565 for the desired amplitude.
10 STEP	Set the LINEARITY switches for 10 STEPS and SUBCARRIER OFF. Adjust C3470 for the desired 10 Step amplitude.
RAMP	Set the LINEARITY switches for RAMP and SUBCARRIER OFF. Adjust R3616 for the desired Ramp amplitude.

COMPOSITE Test Signal with Ramp

As shipped from the factory, the 5 Step Staircase is generated as a portion of the COMPOSITE signal. To replace the steps with a ramp, rotate P3760 (see Fig. 1-21) 180°, and connect P3620 (see Fig. 1-21) between pins 2 and 3.

NOTE

Requires horizontal reprogramming and internal adjustment.

Adjustment Procedure

a. Set the LINEARITY SUBCARRIER switch OFF.

b. Using Fig. 1-17 and Table 1-5 as guides, reprogram the RAMP as follows:

Set, Instant 7 (9-8/0); Reset, Instant 14 (9-26/0).

c. Change the connector between pins 1 and 2 of P3620 (see Fig. 1-21) to pins 2 and 3.

d. Adjust Ramp Amplitude control, R3616, for 80 IRE between blanking and the ramp peak.

APL Bounce Trigger (149A only)

As factory-connected, the FLAT FIELD BOUNCE signal switches on line 57. If desired, the switching can be made to occur at random by changing the connector on pins 2 and 3 of P3926 (see Fig. 1-21) to pins 1 and 2.

@

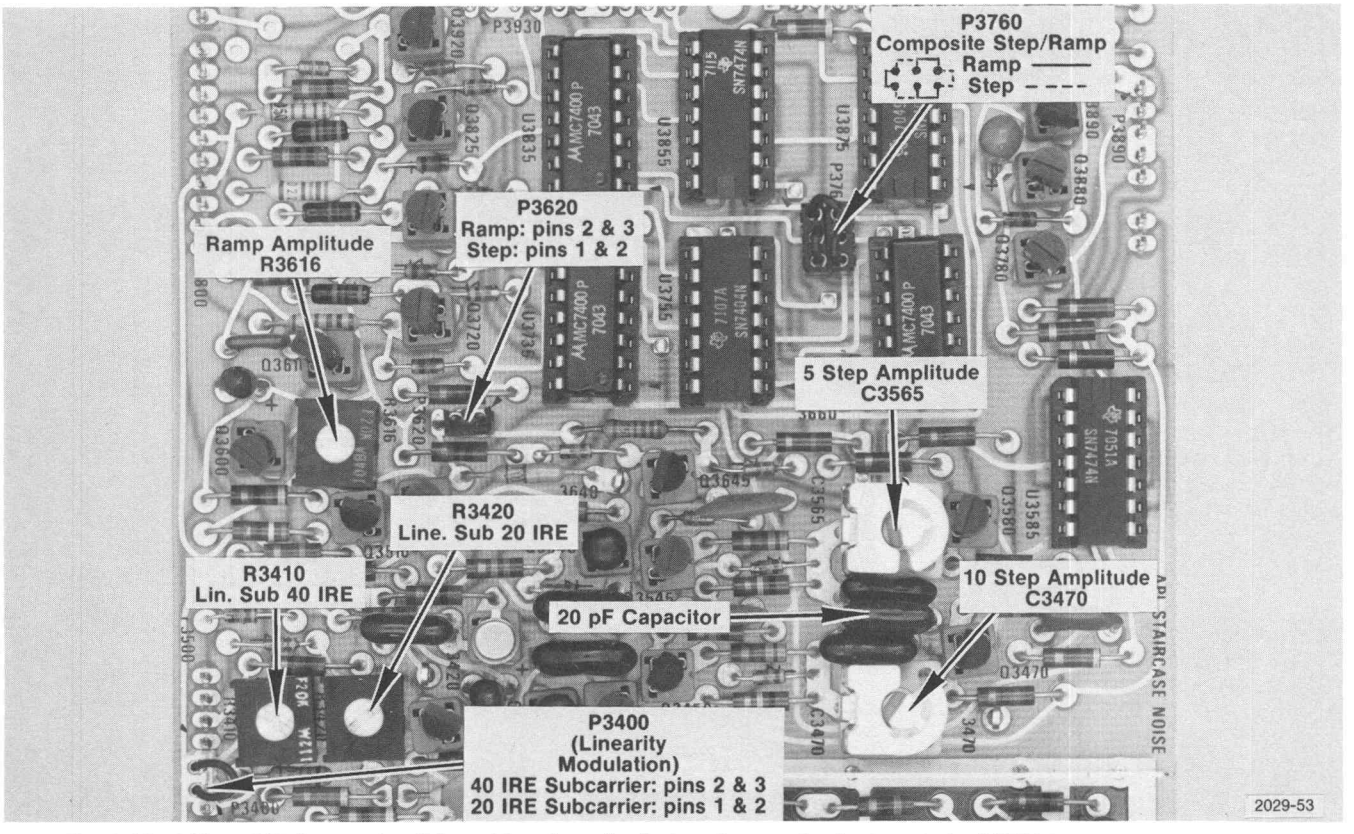


Fig. 1-21. APL and Staircase circuit board location of selector plugs and adjustments for LINEARITY operating changes.

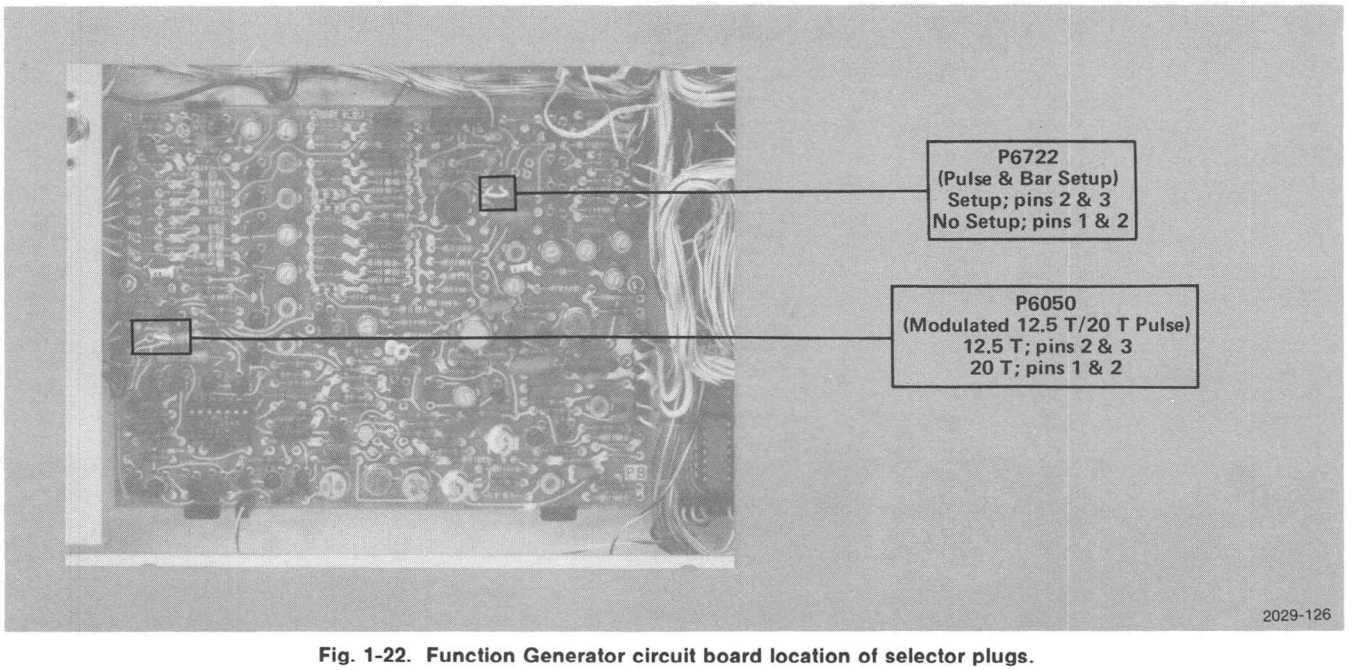


Fig. 1-22. Function Generator circuit board location of selector plugs.

Modulated 12.5T/20T Sine-Squared Pulse

As factory-connected, the 147A or 149A displays the modulated 12.5T Pulse. This may be changed to display the modulated 20T Pulse by changing the connector on pins 2 and 3 of P6050 (see Fig. 1-22) to pins 1 and 2.

NOTE

This reconnection requires internal adjustment.

147A Adjustment Procedure

1. Observe the SIN^2 PULSE AND BAR FULL FIELD TEST SIGNAL OUT signal.

2. Adjust R7661 (Modulation Gain) and R7357 (Luminance Gain) for (1) a peak modulation amplitude of 714 mV, and (2) the best flat bottom on the modulated pulse. See Fig. 1-23 for the location of all adjustments in this procedure.

3. Adjust R7453 (P & B Sync Level) to align the vertical and horizontal blanking levels.

4. Adjust R8630 (Burst Amplitude) for peak-to-peak burst amplitude of 285.6 mV (40 IRE).

5. Observe the LINEARITY test signal. Adjust R3410 (40 IRE Mod Amplitude) for a Linearity Modulation amplitude of 285.6 mV (40 IRE).

6. Move the connector on P3400 to pins 1 and 2. Adjust P3420 (20 IRE Mod Amplitude) for a Linearity Modulation amplitude of 142.8 mV (20 IRE). Replace the connector on P3400 to pins 2 and 3.

7. Observe the MULTIBURST test signal. Adjust R6741 (MB Gain) for a 500 kHz packet amplitude of 642.6 mV (90 IRE).

8. Observe the VIR Signal. Adjust R8380 (VIRS Modulation Amplitude) for a VIRS Modulation amplitude of 285.6 mV (40 IRE).

149A Adjustment Procedure

1. Observe the SIN^2 PULSE AND BAR FULL FIELD TEST SIGNAL OUT signal.

2. Adjust R8109 (Sin^2 Chroma Gain), see Fig. 1-24, and R7357 (Luminance Gain), see Fig. 1-25, for (1) a peak modulation amplitude of 714 mV (100 IRE) and (2) the best flat bottom on the pulse.

3. Adjust R7453 (P & B Sync Level), see Fig. 1-25, until the horizontal and vertical blanking levels are aligned.

Sine-Squared Pulse and Bar Setup

As factory-connected, setup is not present on this signal. Setup can be obtained by changing the connector on pins 1 and 2 of P6722 (see Fig. 1-22) to pins 2 and 3.

NOTE

This reconnection requires internal adjustments.

147A Adjustment Procedure

1. Observe the SIN^2 PULSE AND BAR FULL FIELD OUT signal.

2. Adjust R7131 (2T Pulse Amplitude), see Fig. 1-25, for a peak pulse amplitude of 714 mV (100 IRE).

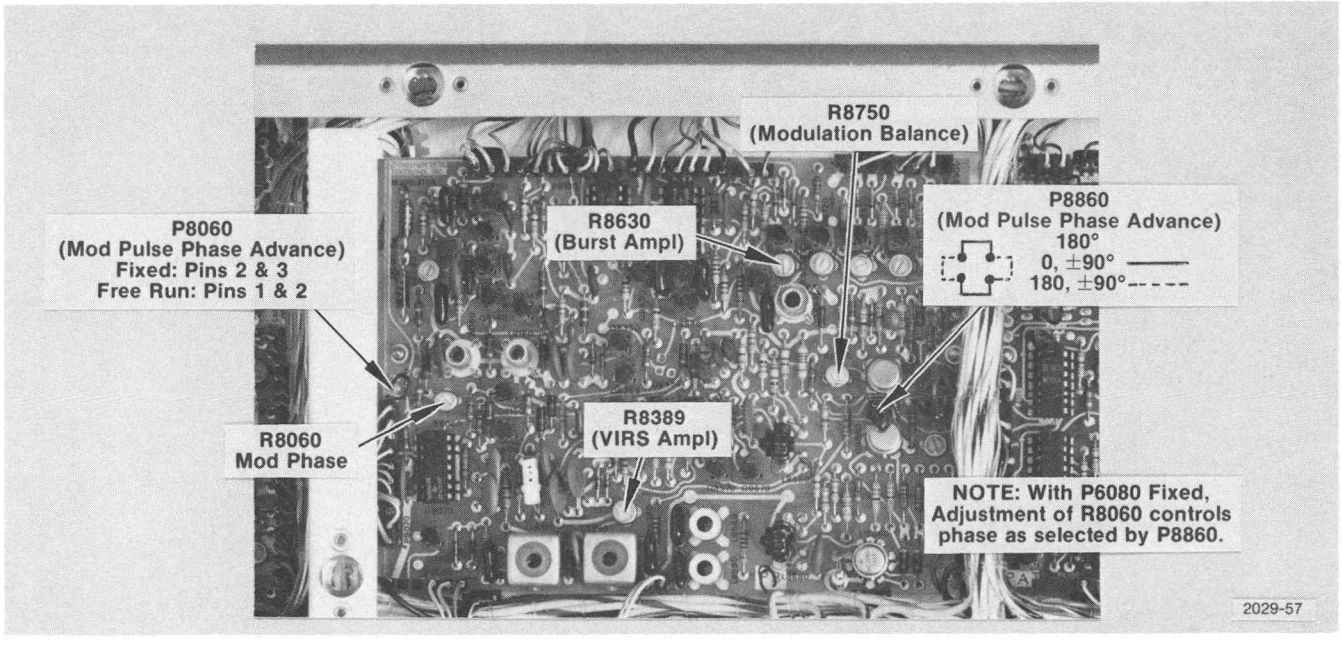


Fig. 1-23. 147A chrominance adjustments.

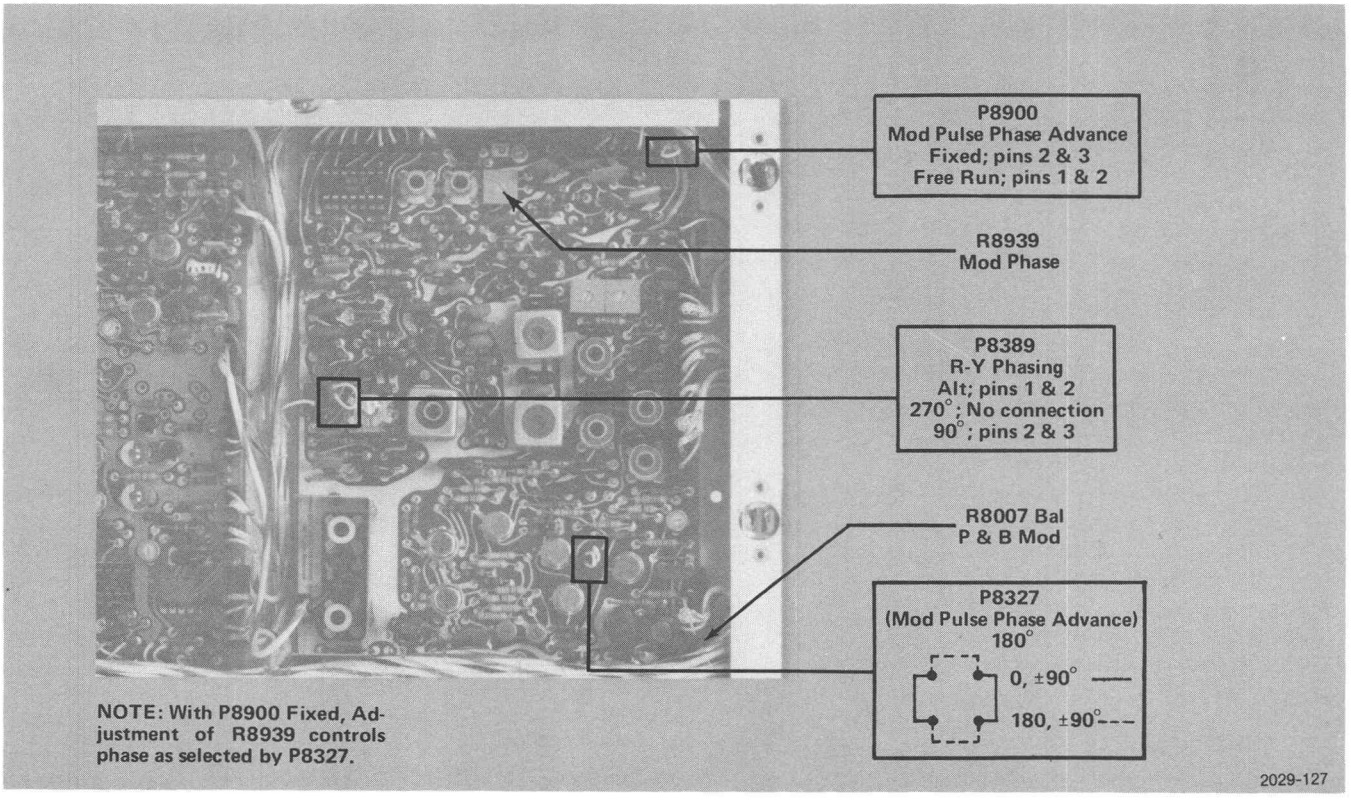


Fig. 1-24. 149A chrominance adjustments.

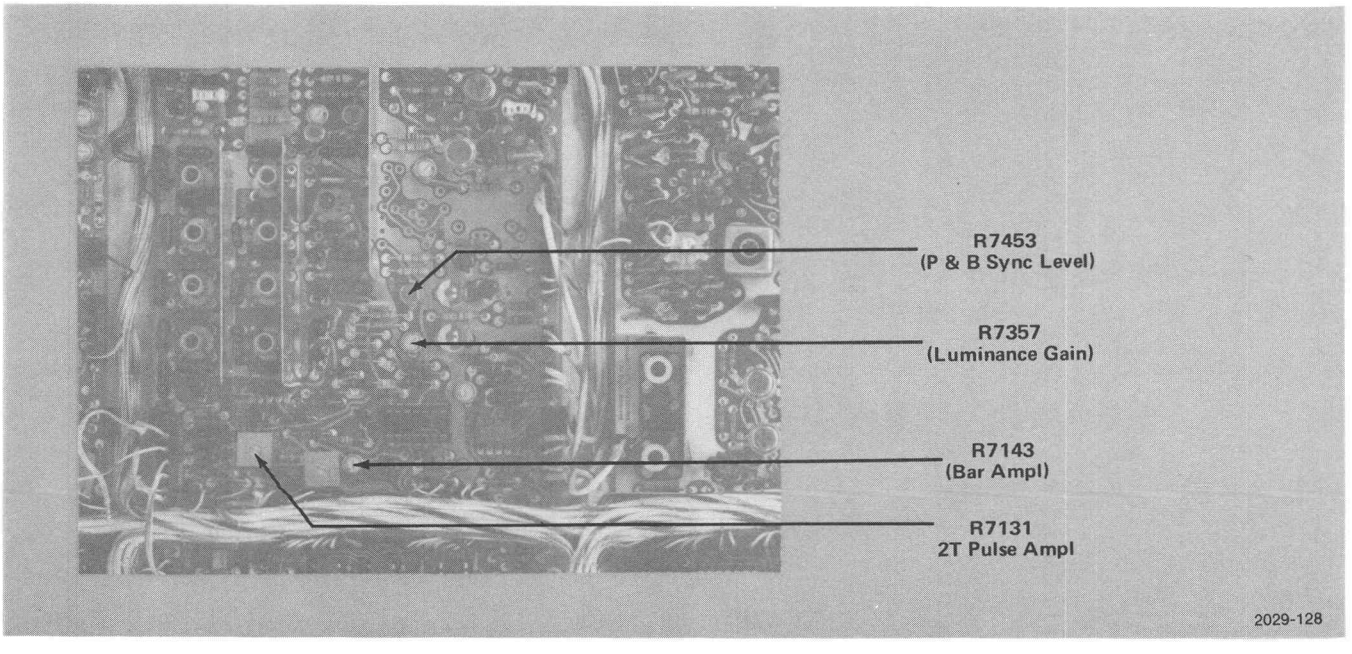


Fig. 1-25. Output Amplifier circuit board location of adjustments.

3. Adjust R7143 (Bar Amplitude) for a peak bar amplitude of 714 mV (100 IRE).

4. Adjust R7357 (Luminance Gain) for equal amounts of chrominance above the 100 IRE level and below the setup level (10 IRE).

5. Adjust R7455 (P & B Sync Level) until the horizontal and vertical blanking levels are aligned.

6. Adjust R7661 (Modulation Gain) until the peak of chrominance within the modulated pulse is at 100 IRE and the bottom portion of chrominance within the modulated pulse is flat at 10 IRE.

7. Adjust R8630 (Burst Amplitude), see Fig. 1-25, for a burst amplitude of 285.6 mV (40 IRE) peak-to-peak.

8. Observe VIRS. (Programmed on line 19 of either field.)

9. Adjust R8380 (VIRS Amplitude) for a VIRS subcarrier amplitude of 285.6 mV (40 IRE) peak-to-peak.

10. Observe the LINEARITY test signal with modulation.

11. Adjust R3420 (40 IRE Modulation Amplitude) for a modulation amplitude of 285.6 mV (40 IRE) peak-to-peak.

12. Change the connector on pins 2 and 3 of P3400 to pins 1 and 2.

13. Adjust R3410 (20 IRE Modulation Amplitude) for a modulation amplitude of 142.8 mV (20 IRE) peak-to-peak.

14. Change the connector on pins 1 and 2 of P3400 back to pins 2 and 3.

149A Adjustment Procedure

1. Observe the SIN^2 PULSE AND BAR FULL FIELD OUT signal.

2. Adjust R7131 (2T Pulse Amplitude), see Fig. 1-25, for a peak pulse amplitude of 714 mV (100 IRE).

3. Adjust R7143 (Bar Amplitude) for a peak bar amplitude of 714 mV (100 IRE).

4. Adjust R7357 (Luminance Gain) for equal amounts of chrominance above the 100 IRE level and below the setup level (10 IRE).

5. Adjust R7453 (P & B Sync Level) until the horizontal and vertical blanking levels are aligned.

6. Adjust R8109 (Sin^2 Chroma Gain), see Fig. 1-24, until the peak of chrominance within the modulated pulse is at 100 IRE and the bottom portion of chrominance within the modulated pulse is flat at 10 IRE.

2T/T Sine-Squared Pulse

As factory-connected, the 147A or 149A displays the 2T Pulse. To display the T Pulse in place of the 2T Pulse, (1) change the connector on pins 1 and 2 of P7131 (see Fig. 1-25) to pins 2 and 3, and (2) change the connector on pins 5 and 6 of P7321 to pins 4 and 5.

T/2T Bar (Integrated Sine-Squared Pulse) (147A)

As factory-connected, the 147A displays the T Bar. To display the 2T Bar in place of the T Bar, change the connector on pins 1 and 2 of P7321 to pins 2 and 3.

2T/T Bar (Integrated Sine-Squared Pulse) (149A)

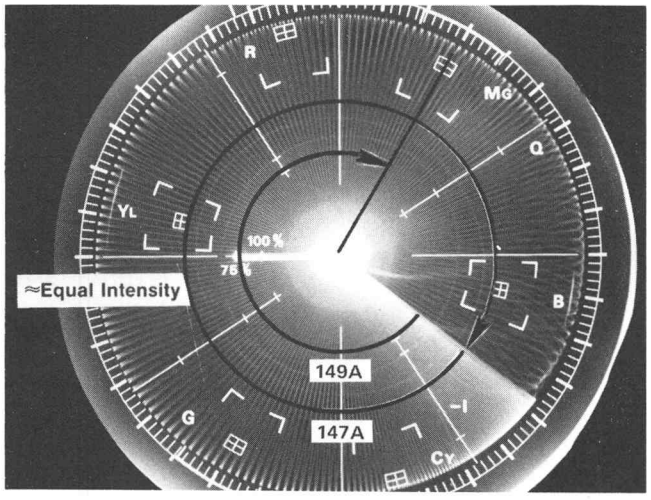
As factory-connected, the 149A displays the 2T Bar. To display the T Bar in place of the 2T Bar, change the connector on pins 2 and 3 of P7321 to pins 1 and 2.

Modulated Sine-Squared Pulse Phase Advance/ Advance 180° (147A)

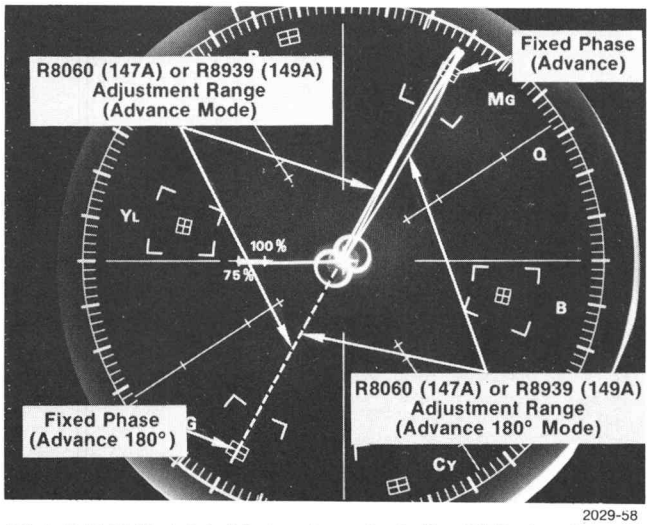
The following changes have been grouped because of interaction.

Phase Advance. As factory-connected, the phase of the Full Field Modulated Sine-Squared Pulse is not fixed. This can be demonstrated by observing the 147A FULL FIELD SIN^2 PULSE AND BAR test signal on a vectorscope. A fan-shaped display, as shown in Fig. 1-26A, will be observed. This enables the test signal to be used where measurement accuracy is of prime importance.

By changing the connector on pins 1 and 2 of P8060, see Fig. 1-23, to pins 2 and 3, the phase of the Full Field Modulated Sine-Squared Pulse will be fixed. This is shown in Fig. 1-26B.



(A) Full Field Modulated Pulse phase; normal operating mode.



(B) Full Field Modulated Pulse phase (including VITS phase) advance and advanced 180° operating modes.

Fig. 1-26. Typical vectorscope display of the modulated pulse in (A) normal mode, and (B) advance mode.

Once Phase Advance has been established, adjustment of R8060 (Mod Phase) can be used to vary the fixed phase to any point within an approximate 180° range.

NOTE

In the Phase Advance mode, the Full Field and VITS Modulated Sine-Squared Pulse have the same phase. This allows source coding of the VIT Signal.

Advance 180°. As discussed above, it is possible to obtain Phase Advance of the Modulated Sine-Squared Pulse during VITS. If needed, the phase can be changed 180° from that obtained with adjustment of R8060 by rotating the connector on P8860 (see Fig. 1-23) by 90°. This provides a 360° control range of the VITS phase.

NOTE

The Phase of the Full Field Modulated Pulse will also be advanced 180° in this mode.

This connection requires internal adjustment.

Adjustment Procedure

1. Observe the SIN^2 PULSE AND BAR FULL FIELD TEST SIGNAL OUT.

2. Adjust R8750 (Modulation Balance), see Fig. 1-23, for minimum modulation on the blanking level.

Modulated Sine-Squared Pulse Phase Advance/ Advance 180° (149A)

The following changes have been grouped because of interaction.

Phase Advance. As factory-connected, the phase of the Full Field Modulated Sine-Squared Pulse is not fixed. This can be demonstrated by observing the 149A FULL FIELD SIN^2 PULSE AND BAR test signal on a vectorscope. A fan-shaped display, as shown in Fig. 1-26A, will be observed. This enables the test signal to be used where measurement accuracy is of prime importance.

By changing the connector on pins 1 and 2 of P8900, see Fig. 1-24, to pins 2 and 3, the phase of the Full Field Modulated Sine-Squared Pulse will be fixed. This is shown in Fig. 1-26B.

Once Phase Advance has been established, adjustment of R8939 (Mod Phase) can be used to vary the fixed phase approximately 180°

NOTE

In the Phase Advance mode, the Full Field and VITS Modulated Sine-Squared Pulse have the same phase. This allows source coding of the VITS.

Advance 180°. As discussed above, it is possible to obtain Phase Advance of the Modulated Sine-Squared Pulse during VITS. If needed, the phase can be changed 180° from that obtained with adjustment of R8939 by rotating the connector on P8327 (see Fig. 1-24) 90°. This provides a 360° control range of the VITS phase.

NOTE

The Phase of the Full Field signal will also be advanced 180° in this mode.

This connection requires internal adjustment.

Adjustment Procedure.

1. Observe the SIN^2 PULSE AND BAR FULL FIELD TEST SIGNAL OUT.

2. Adjust R8007 (P and B Mod Ball), see Fig. 1-24, for minimum modulation on the blanking level.

Modulated Pedestal Half Line (149A only)

As factory-connected, the MODULATED PEDESTAL COLOR TEST SIGNAL occupies a full line. If desired, the horizontal timing may be changed for utilization of active line time.

Proceed as follows: (1) Change the connector on pins 1 and 2 of P402 (see Fig. 1-27) to pins 2 and 3; (2) Change the connector on pins 1 and 2 of P478 to pins 2 and 3; and (3) Change the connector on pins 1 and 2 of P499 to pins 2 and 3.

With the above connections, the MODULATED PEDESTAL will be as shown in Fig. 1-28.

Color Bar R-Y Phase (149A only)

As factory-connected, the color bar R-Y phase is locked to 90° (normal NTSC operation). For test purposes, the R-Y phase can be locked to 270° by removing the connector on P8389 (see Fig. 1-24). For quadrature-phase testing, the R-Y phase can be alternated between 90° and 270° by connecting pins 1 and 2 of P8389.

ALT APL on Alternate Lines

As factory-connected, when ALT APL is selected, the FULL FIELD signal will consist of the selected FULL FIELD SIG on every fifth line, and the FLAT FIELD signal on the remaining 4/5 of the lines. If desired, the sequence may be change to one line of the FULL FIELD SIG alternating with one line of FLAT FIELD. To accomplish this, move the jumper on P4662 from pins 2 and 3 to pins 1 and 2. (See Fig. 1-29.)

Transmitter Protection

To prevent overdriving a transmitter, a video signal should always be present at the transmitter input. Often, one piece of equipment in the video chain will be designated to detect the loss of the program signal, and insert a new signal in its place. The 147A and 149A are factory-connected to automatically bypass the PROGRAM LINE IN to the PROGRAM LINE OUT connector when the incoming signal loses sync. This allows other equipment to detect the signal loss, and to do the appropriate switching of signals.

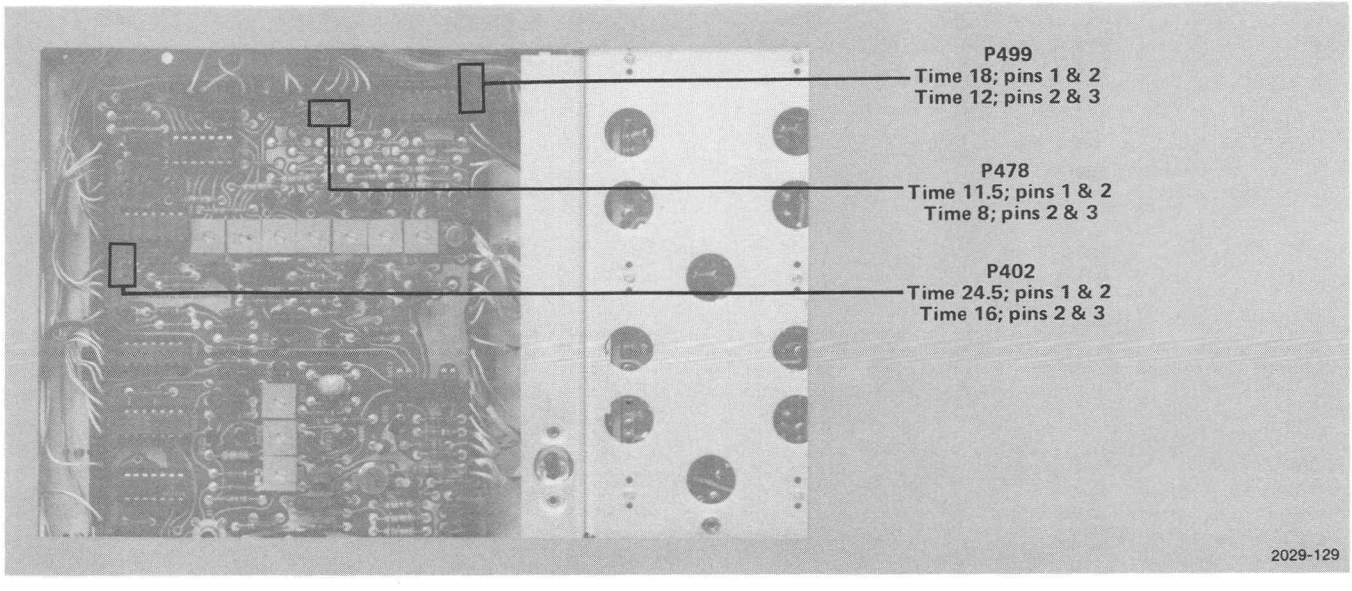


Fig. 1-27. 149A Subcarrier and Sync Out circuit board location of Modulated Pedestal selector plugs.

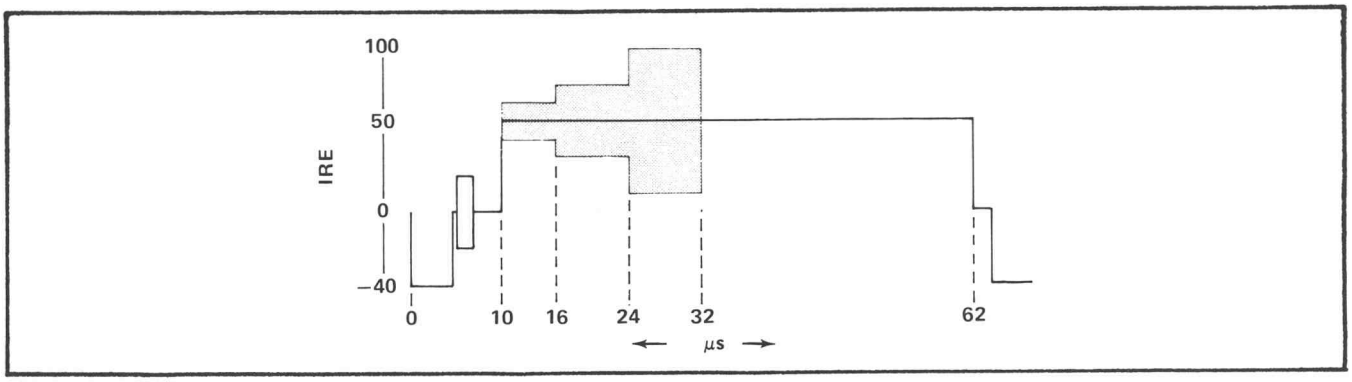


Fig. 1-28. Modulated Pedestal; half line option.

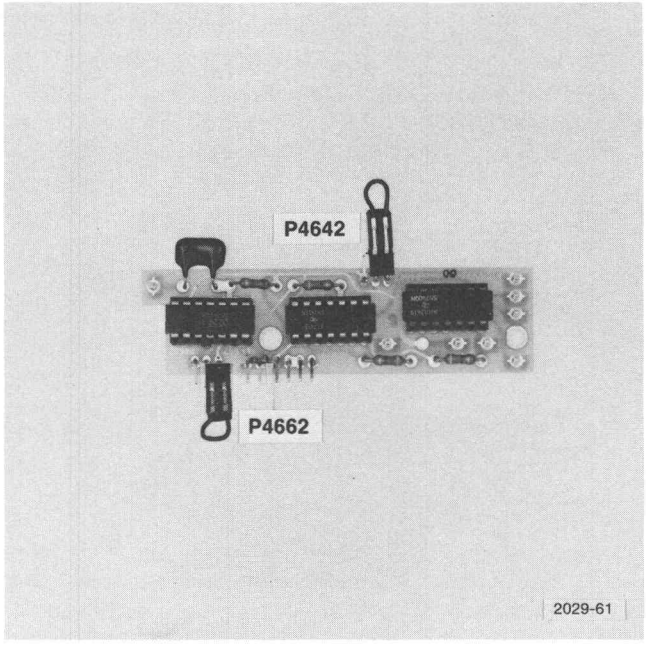


Fig. 1-29. ALT APL circuit board locations of P4662 and P4642.

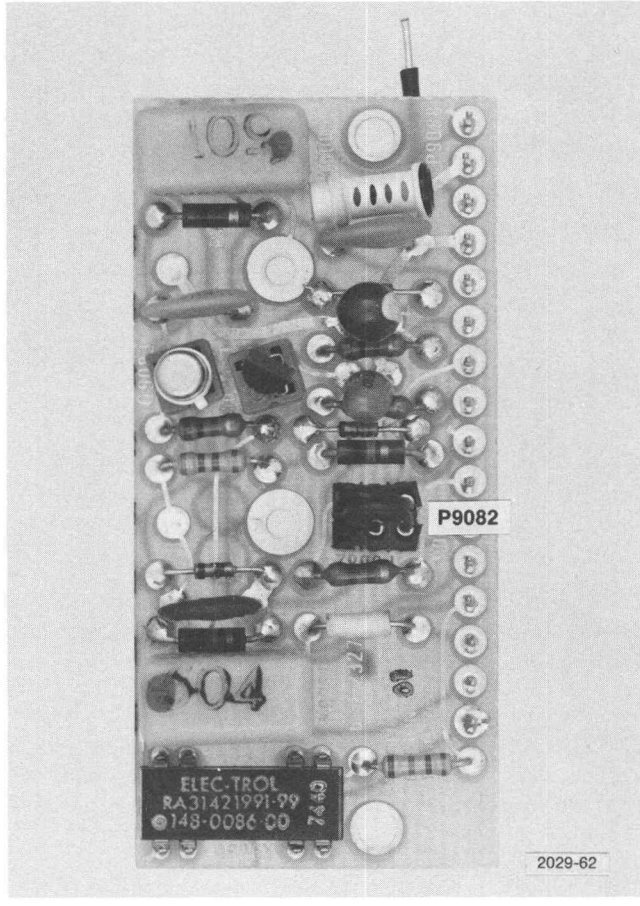


Fig. 1-30. Relay circuit board location of P9082.

If desired, the 147A and 149A can be programmed to insert a full field test signal at the PROGRAM LINE OUT connector if the signal at the PROGRAM LINE IN connector loses sync. P9082, see Fig. 1-30, on the Relay board, must be turned 180°, connecting pin 1 to pin 2 and pin 5 to pin 6. This will provide the Flat Field Test Signal at the output.

To select any other test signals P4642, see Fig. 1-29, must be moved to connect pins 2 and 3. This allows the signal at the output to be selected by the FULL FIELD SIG Selector.

The time between loss of signal and switching of the 147A and 149A is about 1/2 second, determined by the value of C345, see Fig. 1-27. If less delay is desired, C345 can be replaced with a lower value capacitor with the same voltage rating. A minimum value of about 15 μF should be retained in the circuit to avoid relay chatter in the bypass mode, and to avoid switching on a momentary loss of sync.

GLOSSARY OF TERMS

ACTIVE VIDEO LINES: All video lines not occurring in the vertical blanking interval.

APL: Average picture level. The average signal level, with respect to blanking level, during active picture scanning time, expressed as a percentage of the difference between the blanking and reference white levels.

BACK PORCH: That portion of the composite video signal which lies between the trailing edge of the horizontal sync pulse and the trailing edge of the horizontal blanking pulse.

BLACK BURST: A signal consisting of composite sync and burst. Normally has setup.

BLANKING LEVEL: The level of the front and back porches of the composite video signal. Normally at 0 IRE.

BREEZEWAY: In NTSC color, the portion of the back porch between the trailing edge of the sync pulse and the start of the color burst.

BURST FLAG: Pulses used to key out a portion of the 3.579545 MHz sine wave subcarrier for use as a reference for the color signal.

CHROMINANCE: That property of light which produces a sensation of color in the human eye apart from any variation in luminance that may be present.

COLOR BAR: A test signal, typically containing eight basic colors: white, yellow, cyan, green, magenta, red, blue, and black, which is used to check the chrominance functions of color TV systems.

COLOR BURST: In NTSC color systems, this normally refers to a burst of approximately 8 to 10 cycles of 3.579545 MHz subcarrier frequency on the back porch of the composite video signal to establish a frequency and phase reference for the chrominance signal.

COLOR SUBCARRIER: In color systems, this is the carrier signal whose modulation sidebands are added to the monochrome signals to convey color information; in NTSC, it is a 3.579545 MHz sinewave.

COMPOSITE BLANKING: This signal is composed of pulses at line and field frequencies used to make the return traces of a picture tube invisible.

COMPOSITE SYNC: The line and field rate synchronizing pulses (including the field equalizing pulses) when combined together form the composite sync signal.

COMPOSITE VIDEO: For color, this consists of blanking, field and line synchronizing signals, color synchronizing signals, chrominance and luminance picture information. These are all combined to form the complete color video signal.

DIFFERENTIAL GAIN: The difference between (1) the ratio of the output amplitude of a small, high-frequency sine-wave signal at two stated levels of a low frequency signal on which it is superimposed and (2) unity.

DIFFERENTIAL PHASE: The difference in output phase of a small high-frequency sine-wave signal at two stated levels of a low-frequency signal on which it is superimposed.

EIA: An abbreviation for Electronic Industries Association.

EQUALIZING PULSES: Pulses of one half the width of the horizontal sync pulses which are transmitted at twice the rate of the horizontal sync pulses during the portions of the vertical blanking interval immediately preceding and following the vertical sync pulses. The purpose of these pulses is to cause the vertical deflection to start at the same time in each interval, and also serves to keep the horizontal sweep circuits in step during the portions of the vertical blanking interval immediately preceding and following the vertical sync pulse.

FIELD: One half of a complete picture (or frame) interval, containing all of the odd, or all of the even, lines of the picture.

FIELD BLANKING: Refers to the blanking signals which occur at the end of each field. Also called vertical blanking.

FIELD FREQUENCY: The rate at which one complete field is scanned, normally 59.94 times a second in NTSC.

FRAME: One complete picture consisting of two fields of interlaced scanning lines.

FRONT PORCH: That portion of the composite picture signal which lies between the leading edge of the horizontal blanking pulse and the leading edge of the corresponding sync pulse. Normally 1.59 μs.

GEN LOCK: Subcarrier to burst lock.

H RATE: The time for scanning one complete line, including trace and retrace. NTSC equals 1/15,734 second (color) or 63.56 μs.

IRE: An abbreviation for Institute of Radio Engineers.

IRE SCALE: An oscilloscope scale that applies to composite video levels. There are 140 IRE units in 1 volt.

LINE BLANKING: The blanking signal at the end of each scanning line. Used to make the horizontal retrace invisible. Also called horizontal blanking.

LINE FREQUENCY: The number of horizontal scans per second, normally 15,734.26 times per second in NTSC.

LUMINANCE (Y): The amount of light intensity, which is perceived by the eye as brightness (referred to as 'Y').

NTSC: National Television Systems Committee. An industry-wide engineering group which, during 1950-1953, developed the color television specifications now established in the United States.

REFERENCE WHITE LEVEL: The level corresponding to the specified maximum excursion of the luminance signal in the white direction.

SETUP: The separation in level between blanking and reference black levels. Normally 7.5 IRE.

STAIRCASE: A video test signal containing several steps at increasing luminance levels. The staircase signal is usually amplitude modulated by the subcarrier frequency and is useful for checking amplitude and phase linearities in video systems.

SYNC: An abbreviation for the words 'synchronization', 'synchronizing', etc. Applies to the synchronization signals, or timing pulses, which lock the electron beam of the picture monitors in step, both hroizontally and vertically, with the electron beam of the pickup tube. The color sync signal (NTSC) is known as the color burst.

VERTICAL BLANKING INTERVAL: The blanking portion at the beginning of each field. It contains the equalizing pulses, the vertical sync pulses, and VITS (if desired). Presently 18-21 lines duration.

VERTICAL DRIVE: A pulse at field rate used in TV cameras. Its leading edge is coincident with the leading edge of the vertical blanking pulse and its duration may be 10.5 lines.

VIRS: Vertical Interval Reference Signal. A reference signal authorized by the Federal Communications Commission for use on line 19 of the vertical interval.

VITS: Vertical Interval Test Signal. A signal which may be included during the vertical blanking interval to permit inservice testing and adjustment of video transmission.

SPECIFICATIONS

TABLE 1-6

Program Control System

Characteristic	Performance Requirement
Signal Input Level	
UNITY GAIN	±0.5% of Unity Gain.
VAR	1 V P-P variable ±30%.
PROGRAM Input Impedance	75 Ω nominal.
PROGRAM Input Return Loss	
POWER ON	At least 46 dB to 5 MHz.
POWER OFF or BYPASS	At least 40 dB to 5 MHz.
Output Impedance (All)	75 Ω nominal.
Output Return Loss (All)	At least 36 dB to 5 MHz.
Output Blanking DC Level (All)	0 V ±50 mV.
Isolation	
PROGRAM to PREVIEW MON OUT	At least 46 dB to 5 MHz.
PROGRAM to PROGRAM MON OUT	At least 34 dB to 5 MHz.
Inserted Signal Amplitude	±1% of nominal input amplitude.
Amplitude Ratio	
2T Pulse to Bar	100% ±0.25% (149), 100% ±0.5% (147A).
Mod Sin^2 Pulse (Chrominance + Luminance)	100% ±0.5% (149A), 100% ±1.0% (147A).
Waveform Tilt	
Field Rate Square Wave	0.5% or less.
25 μs Bar	0.5% or less.
Differential Phase (10-90 APL)	
PROGRAM OUTPUT	0.15° or less.
PREVIEW OUTPUT	0.3° or less.
Differential Gain (10-90 APL)	
PROGRAM OUTPUT	0.2% or less.
PREVIEW OUTPUT	0.4% or less.

TABLE 1-6 (cont)

Characteristic	Performance Requirement
Line Time Amplitude Non-Linearity (unmodulated staircase)	0.25% or less.
Random Noise Output	
Program Output	At least 75 dB (RMS) down.
Residual Subcarrier	At least 60 dB down.
Hum or Transients	At least 60 dB down.
Spurious Signals During Blanking Lines	At least 40 dB down.
External Signal Attenuation in "Delete" Mode	
2T Pulse	At least 70 dB.
Subcarrier (Color Bars)	At least 60 dB.
Crosstalk into Program Channel from Internal Signal	
2T Pulse	At least 70 dB down.
Subcarrier (Staircase)	At least 60 dB down.
Adjustment Range of Inserted Signal Blanking for use with External Sync	At least ±3 μs.
INSERT DELAY Range	At least ±0.5 μs (1 μs total).
Time Jitter	5 ns or less.
Unwanted Pedestal at time of VITS Insertion	0.7 IRE or less.

TABLE 1-7

Test Signals

Characteristic	Performance Requirement
FLAT FIELD Signal	
BOUNCE (10-90 APL)	Automatic bounce between 10 and 90 IRE ±2 IRE.
RATE	Adjustable from approximately 1 second to greater than 10 seconds.
VARIABLE	0-100 IRE in 10 IRE increments, equal within 2%.
Risetime	≈230 ns.
Timing	See Fig. 1-9.

TABLE 1-7 (cont)

Characteristic	Performance Requirement
FIELD SQUARE WAVE	
Amplitude	100 IRE ±2 IRE.
Lines at White	Lines 57 through 227 in each field.
Lines at Blanking	All other active lines.
Risetime	230 ns ±15%.
Timing	See Fig. 1-9.
NOISE Signal (147A only)	
Pedestal Amplitude	
10 IRE	10 IRE ±0.2 IRE.
50 IRE	50 IRE ±1 IRE.
100 IRE	100 IRE ±2 IRE.
Variable Pedestal Range (Insertion Mode only)	±10 IRE from nominal.
Noise Amplitude	−20 dB to −59 dB (0 dB = 700 mV RMS).
Noise Attenuator Accuracy	±1 dB.
Noise Spectrum Bandwidth	15 kHz to 5 MHz, flat within 6 dB.
Timing	See Fig. 1-9.
COLOR TEST SIGNAL (149A only)	
Luminance and Chrominance	Absolute amplitudes of luminance signal, set-up, and sync are within 1% or 1.5 mV, whichever is greater, with respect to blanking. Absolute amplitudes of all subcarrier frequency components (B-Y, R-Y) are within 3%. With the red chrominance bar as an absolute reference, all other subcarrier frequency component amplitudes are within 1% or 1 mV plus the peak-to-peak residual subcarrier amplitude, whichever is greater, of their assigned values listed below.
Blanking Level (With respect to ground)	0 V within 50 mV.
75% Amplitude, 7.5% Setup	Millivolts

	Lum	Chroma (P-P)	B-Y (P-P)	R-Y (P-P)
White	714.3	2.5 or less	- - - -	- - - -
Yellow	494.6	445.1	434.7	95.6
Cyan	400.4	625.9	146.5	608.5
Green	345.9	588.3	288.2	512.9
Magenta	256.7	588.3	288.2	512.9
Red	202.2	625.9	146.5	608.5
Blue	108.1	445.1	434.7	95.6
Black	53.6	2.5 or less	- - - -	- - - -

TABLE 1-7 (cont)

Characteristic	Performance Requirement			
	Lum	Chroma (P-P)	B-Y (P-P)	R-Y (P-P)
Blanking Level	0	2.5 or less	- - - -	- - - -
Sync	−285.7	2.5 or less	- - - -	- - - -
Burst	0	285.7	285.7	0
Chrominance				
Time Difference Between Luminance and Chrominance	20 ns or less.			
B-Y, R-Y Quadrature Error	0.5° or less.			
R-Y Axis Phase Switcher	0.5° or less.			
Residual Subcarrier	At least 52 dB below 1 V on White, Black, (2.5 mV peak-to-peak or less).			
Aberrations	Within 4% P-P of 1 V.			
Spurious Subcarrier	At least 52 dB below 1 volt, except 30 dB at the end of H Blanking.			
Other Spurious Outputs	At least 52 dB below 1 volt, except 30 dB down during Sync and at the end of H Blanking.			
COLOR BARS	VITS Color Bar as per FCC Rules and Regulations Fig. No. 14, 73.699. See Fig. 1-9.			
Luminance Risetime	250 ns within 50 ns.			
Chrominance Risetime	400 ns within 15%.			
Bar Duration	8 μs each.			
Timing				
SPLIT FIELD				
Luminance Component	All active lines.			
Chrominance Component	All active lines programmed for "WINDOW" signal (lines 66-218 of each field).			
FULL FIELD	All active lines.			
MODULATED PEDESTAL				
Pedestal				
Amplitude	50 IRE within 0.5 IRE.			
Risetime	250 ns within 50 ns.			
Tilt	0.3% or less of Pedestal Amplitude.			
Timing	See Fig. 1-9.			

TABLE 1-7 (cont)

Characteristic	Performance Requirement
Chrominance Levels	
20 IRE	20 IRE peak-to-peak, within 0.5 IRE.
40 IRE	40 IRE peak-to-peak, within 0.5 IRE.
80 IRE	80 IRE peak-to-peak, within 0.5 IRE.
0 IRE	2.5 mV peak-to-peak or less.
Chrominance Phase	
Relative to Burst	90° within 1.0°.
Relative to Phase of other two levels	0° within 0.2°.
Harmonic Distortion	Less than 1%.
Risetime of Modulated Envelope	375 ns within 50 ns.
SIN^2 PULSE & BAR	
Modulated Pulse	
Amplitude	100% ±0.5% of Bar.
HAD (Half-Amplitude Duration)	
12.5T (Factory-Set)	1.57 μs ±75 ns.
20T (Available by jumper option)	2.5 μs ±100 ns.
Luminance Amplitude	50 IRE within 0.25 IRE.
Chrominance/Luminance Peak Amplitude Diff.	0.5% or less.
Chrominance/Luminance Delay	5 ns or less (149A), 10 ns or less (147A).
Other Perturbations on Baseline	Less than 0.5 IRE.
Harmonic Content of Subcarrier	At least 40 dB down.
Phase	
VITS Range	0° to 360°.
FULL FIELD	Phase modulated at field rate.
Pulse	
2T Pulse-to-Bar Ratio	100% ±0.5%.
T Pulse-to-Bar Ratio	100% ±1%.
HAD	
2T (Factory-Set)	250 ns ±15%.
T (Available by jumper option)	125 ns ±15%.
Ringing Amplitude	0.5 IRE or less.
Ringing Duration	4 cycles or less.
Bar	
Amplitude	100 IRE ±1 IRE.
Risetime	
T (Factory-Set 147A, Available by jumper 149A)	115 ns ±15%.
2T (Factory Set 149A, Available by jumper 147A)	230 ns ±15%.
Timing	See Fig. 1-9.

TABLE 1-7 (cont)

Characteristic	Performance Requirement
WINDOW Signal	
Amplitude	Same as Bar.
Risetime	Same as Bar.
Duration	26 μs/Line X 152 lines (lines 66 through 218.
COMPOSITE Signal	
Modulate 5-Step Staircase (Ramp available by jumper option)	
Luminance	
Amplitude	90 IRE ±1 IRE (adjustable ±10 IRE).
Riser Amplitude	1/5 of 5-Step Amplitude ±1%.
Risetime (All Identical)	≈230 ns.
Chrominance	
Phase	180°.
Amplitude	40 IRE ±0.5 IRE.
Inherent Differential Gain	0.5% or less.
Inherent Differential Phase	0.2° or less.
Envelope Rise and Fall Times	≈375 ns.
Pulse	
2T Pulse-to-Bar Ratio	100% ±0.5%.
T Pulse-to-Bar Ratio	100% ±1%.
HAD	
2T (Factory-Set)	250 ns ±15%.
T (Available by jumper option)	125 ns ±15%.
Ringing Amplitude	0.5 IRE or less.
Ringing Duration	4 cycles or less.
Modulated Sin^2 Pulse	
Amplitude of Luminance Component	50 IRE ±1 IRE.
Amplitude Difference of Peak Chrominance to Peak Luminance	0.5 IRE or less.
Chrominance to Luminance Delay	5 ns or less.
Other Perturbations on Baseline	0.5 IRE or less.
Harmonic Distortion of Subcarrier	At least 40 dB down.
Phase	
VITS Range	0° to 360°.
FULL FIELD	Phase modulated at field rate.

TABLE 1-7 (cont)

Characteristic	Performance Requirement
Bar	
Amplitude	100 IRE ±1 IRE.
Risetime	
T (Factory-Set 147A, Available by jumper 149A)	115 ns ±15%.
2T (Factory-Set 149A, Available by jumper 147A)	230 ns ±15%.
Timing	See Fig. 1-9.
LINEARITY Signal	
Luminance	
Staircase Signal	
Amplitude	
10 Step	90 IRE ±1 IRE (adjustable ±10 IRE).
5 Step (147A)	90 IRE ±1 IRE (adjustable ±10 IRE).
5 Step (149A)	80 IRE ±1 IRE (adjustable to 100 IRE).
Riser	
10 Step	1/10 of 10 Step Amplitude ±1%.
5 Step	1/5 of 5 Step Amplitude ±1%.
Risetime (All Identical)	≈230 ns.
RAMP Signal	
Amplitude	90 IRE ±1 IRE (adjustable within 10 IRE).
Linearity	Within 1%.
Chrominance	
Amplitude	40 IRE ±0.5 IRE.
Inherent Differential Gain	0.5% or less.
Inherent Differential Phase	0.2° or less.
Envelope Rise and Fall Times	≈375 ns.
Phase	180°.
Timing	See Fig. 1-9.
MULTIBURST Signal	
White Reference Amplitude	100 IRE ±1 IRE.
Burst Amplitude (Peak-to-Peak)	
NORMAL	90 IRE ±1 IRE.
REDUCED	60 IRE ±1 IRE.
Average Level	
NORMAL	55 IRE ±1 IRE.
REDUCED	40 IRE ±1 IRE.

TABLE 1-7 (cont)

Characteristic	Performance Requirement
Burst Frequencies	0.5 MHz ±3%. 1.25 MHz ±3% (149A). 1.5 MHz ±3% (147A). 2.0 MHz ±3%. 3.0 MHz ±3%. 3.58 MHz ±3%. 4.1 MHz ±2% (149A). 4.2 MHz ±2% (147A).
Burst Harmonic Content	At least 40 dB down.
Burst Phasing	Each burst starts and stops at 0°.
Timing	See Fig. 1-9.
VERTICAL INTERVAL REFERENCE SIGNAL (VIRS)	
Chrominance Reference	
Amplitude	40 IRE ±0.4 IRE.
Phase	180° (adjustable with INSERT SUBCARRIER PHASE).
Envelope Risetime	1 μs ±15%.
Average Level of Chrominance Signal	70 IRE ±0.7 IRE.
Luminance Reference	
50 IRE Level	50 IRE ±0.5 IRE.
Black Reference	7.5 IRE ±0.5 IRE.
Timing	See Fig. 1-9.

TABLE 1-8

Full Field Output

Characteristic	Performance Requirement
Full Field Test Signal Outputs	
Amplitude Relative to Inserted Signals of Same Type	Within 1% (both outputs).
Sync Amplitude	−40 IRE ±1 IRE.
Sync Timing	See Fig. 1-31.
Burst Amplitude (Peak-to-Peak)	40 IRE ±0.5 IRE.
Burst Phase	180° ±1°.
Burst Timing	See Fig. 1-31.
Chrominance Subcarrier Frequency	
Free Run	3.579545 MHz ±25 Hz.
Locked Mode	Locked to incoming Burst or Subcarrier.
Return Loss	At least 36 dB to 5 MHz.

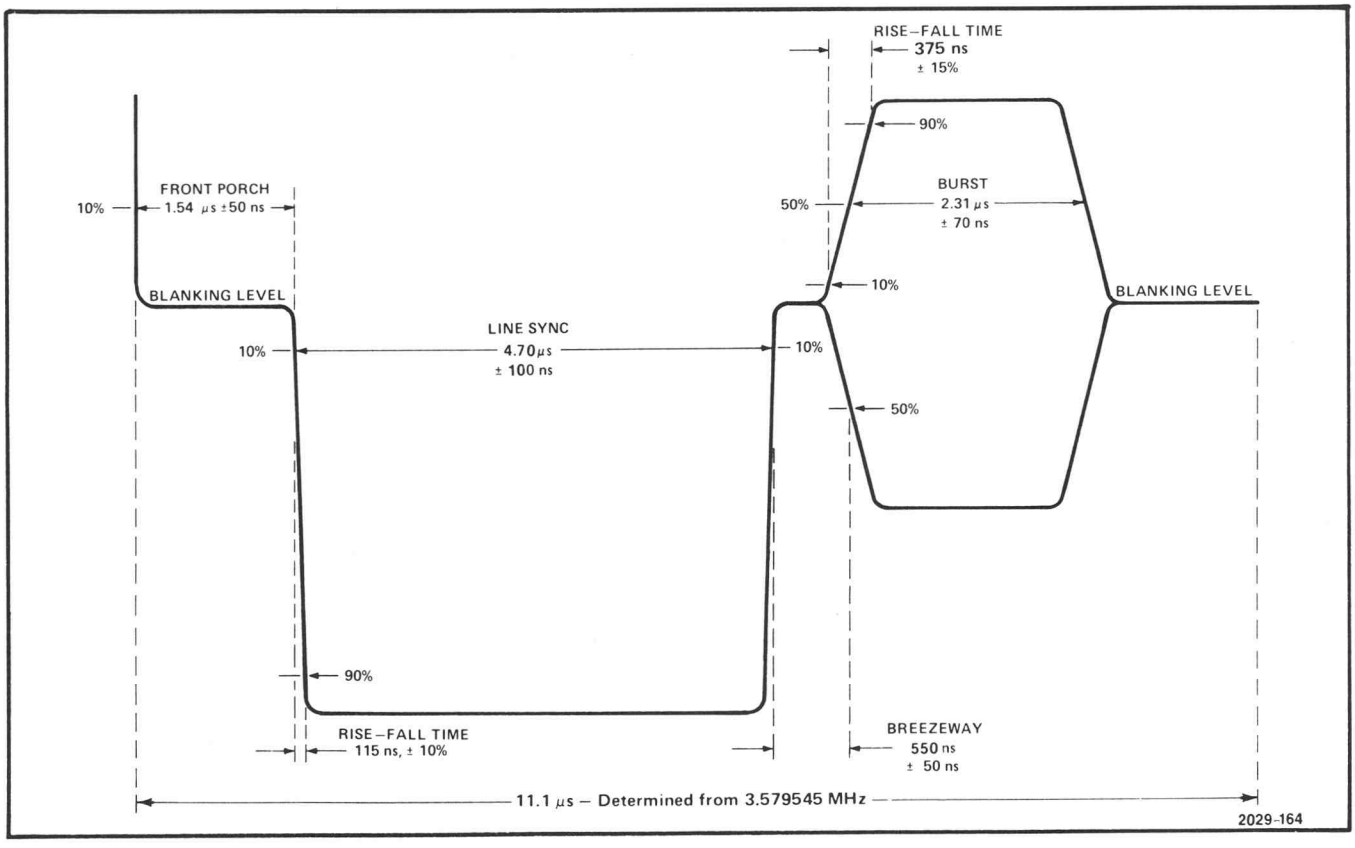


Fig. 1-31. Horizontal blanking details.

TABLE 1-9

Other Signal Outputs

Characteristic	Performance Requirement
COMPOSITE SYNC (see Fig. 1-32)	
Amplitude	4 V, Negative-going, ±10%.
Return Loss	At least −30 dB to 3.6 MHz.
Rise and Fall Times	115 ns ±15%.
Line Sync Duration	4.71 μs ±50 ns.
Line Period	63.56 μs.
Equalizer Pulse	
Duration	2.33 μs ±50 ns.
Sequence Duration	3 lines each.
Field Sync Pulse	
Duration	27.3 μs ±0.2 μs.
Sequence Duration	3 lines.
Interval between Pulses	4.5 μs ±0.2 μs.

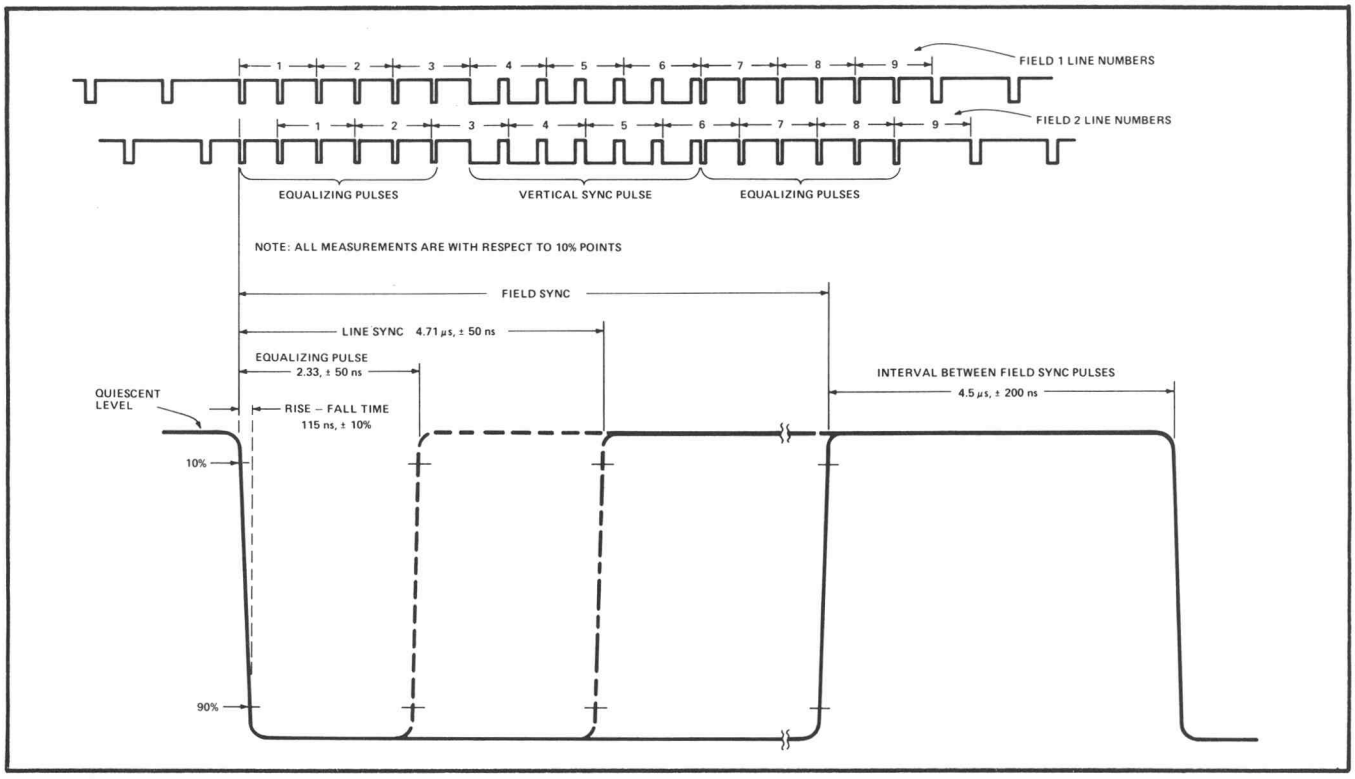


Fig. 1-32. Composite Sync details.

TABLE 1-9 (cont)

Characteristic	Performance Requirement
Field Period	262.5 lines.
Note:	COMPOSITE SYNC is disabled with a loss of incoming sync.
CW SUBCARRIER	
Amplitude	2 V P-P ±10% into 75 Ω.
Return Loss	At least −30 dB to 5 MHz.
Frequency	Locked to incoming burst.
Note:	CW SUBCARRIER is disabled with a loss of incoming sync or burst.
NOISE (147A only)	
Noise Amplitude	−20 dB to −59 dB (using a 4.2 MHz low-pass filter). (0 dB = 700 mV.)
Noise Attenuator Accuracy	Within 1 dB.
Noise Spectrum Bandwidth	15 kHz to 5 MHz, flat within 6 dB.
Return Loss	At least −30 dB to 5 MHz.

TABLE 1-10

Power Supply

Characteristic		Performance Requirement
Line Voltage Range		
115 Vac	Low	90 V to 110 V
	Medium	104 V to 125 V
	High	112 V to 136 V
230 Vac	Low	180 V to 220 V
	Medium	208 V to 252 V
	High	224 V to 272 V
Crest Factor		At least 1.35
Maximum Line Current		0.5 A
Maximum Power Consumption		40 W
Line Frequency Range		48 to 66 Hz

TABLE 1-11

Physical

Characteristic	Information	
Finish	Cabinet is blue-vinyl painted. Front panel is anodized aluminum.	
Dimensions	Rackmount	Bench Model
Overall		
Height	8.81 cm (3.47 inches)	9.7 cm (3.82 inches)
Width	48.26 cm (19.0 inches)	46.36 cm (18.225 inches)
Length	49.94 cm (19.66 inches)	48.51 cm (19.1 inches)
Cabinet	Rackmount	Bench Model
Height	- - - -	8.81 cm (3.47 inches)
Width	42.88 cm (16.88 inches)	43.43 cm (17.1 inches)
Length	46.76 cm (18.41 inches)	46.76 cm (18.41 inches)
Width Over Sides	44.77 cm (17.625 inches)	- - -
Length with BNC-T	47.24 cm (18.6 inches)	48.03 cm (18.91 inches)
Length with BNC Cable to Connector	47.42 cm (28.67 inches)	48.21 cm (18.98 inches)

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ENVIRONMENTAL CHARACTERISTICS

The following environmental test limits apply when tested in accordance with the recommended test procedure. This instrument will meet the electrical performance requirements given in this section following an environmental test. Complete details on environmental test procedures, including failure criteria, etc., may be obtained from Tektronix, Inc. Contact your local Tektronix Field Office or representative.

TABLE 1-12
Environmental

Characteristic	Information
Temperature	
Non-Operating Range	−40°C to +65°C
Operating Range	0°C to +50°C
Altitude	
Non-Operating Range	To 50,000 feet
Operating Range	To 15,000 feet

ACCESSORIES

Standard accessories supplied with this instrument are listed in the Mechanical Parts List.

MAINTENANCE

This section of the manual contains information for use in maintenance of the 147A or 149A as follows.

Preventive Maintenance: Cleaning, lubrication, visual inspection, etc.

Troubleshooting: Aids for isolating trouble to a particular stage, etc.

NOTE

Maintenance and repair of the 147A and 149A should be performed or supervised by a qualified technician or engineer familiar with solid state circuitry.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, and lubrication. Preventive maintenance performed on a regular basis may prevent instrument breakdown, and will improve the reliability of this instrument.

Cleaning

General. The 147A or 149A should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket that prevents efficient heat dissipation. It also provides an electrical conduction path.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain benzene, toluene, xylene, acetone, or similar solvents.

Exterior. Loose dirt accumulated on the outside of the instrument can be removed with a soft cloth or small paint brush. The paint brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt which remains can be removed with a soft cloth dampened in a solution of water and mild detergent. Abrasive cleaners should not be used.

Interior. Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low velocity air. Remove any dirt which remains with a soft paint brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

Lubrication

The reliability of switches and other moving parts can be maintained if they are kept properly lubricated. Use a cleaning-type lubricant (e.g., Tektronix Part No. 006-0172-00) for switch contacts. This lubricant does not affect the electrical characteristics of the switch. To lubricate the switch detent, use a heavier lubricant (e.g., Tektronix Part No. 006-0219-00). Do not over-lubricate.

Visual Inspection

The instrument should be inspected occasionally for such defects as broken connections, loose or disconnected pin connectors, improperly seated solid-state devices, damaged circuit boards and heat-damaged components.

The correct procedure for most defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

Transistor and Integrated Circuit Checks

Periodic checks of the transistors and integrated circuits (IC's) used in the instrument are not recommended. The best indication of performance is the actual operation of the component in the circuit. Performance of the circuit is thoroughly checked when performing either the performance check or calibration procedure. Any substandard transistors or integrated circuits will usually be detected at that time.

TROUBLESHOOTING

The following information is provided to facilitate troubleshooting of the 147A or 149A. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles.

Troubleshooting Aids

Diagrams. Circuit diagrams are provided on foldout pages at the rear of this manual. Each component, its electrical value and circuit number are shown on the diagrams. In addition, typical voltages which can be expected are also shown.

Each diagram has been assigned a diagram number and name. For example, the first diagram has been assigned the number 1 and is called PROGRAM LINE AMPLIFIER. (Other circuitry exists on this diagram but, since the program line amplifier is of prime importance, it was so called.) Notice the solid blue line that surrounds most of the circuitry on this diagram. This line is used to identify a particular circuit board on which the components are physically located. This reference allows for correlation between the diagrams, circuit boards, and electrical parts list. All other components on the circuit board will be found on diagram 2.

Table 2-1 lists the various electrical numbers, circuit boards, and reference digrams used in the 147A or 149A. All components located outside the blue line are chassis mounted components and have numbers from 9000 to 9499.

Circuit Boards. Fig. 2-1 shows the location of each circuit board within the instrument. Each circuit board is shown (full view) opposite the appropriate diagram in the Diagram section. Each electrical component on the board is identified by its circuit number. In most cases, these circuit numbers were assigned on a grid system as a convenience to the user of the instrument. For example, notice the circuit board photo opposite diagram 1. The upper left-hand corner of this board has been assigned numbers around 500. Proceeding left to right, the numbers go towards 900 at the upper right-hand corner. From top to bottom, the numbers increase to 590 at the bottom left corner and 991 at the bottom right corner. Using this method, the physical location of each component is readily available.

TABLE 2-1

Circuit Numbers	Function or Circuit Board Name	Diagram
0-499	Subcarrier & Sync	19 (149A) & 20
500-999	VITS Insertion	1 & 2
1000-1999	Horiz and Vert Counters	3 & 4
2000-2999	Horiz Timing	5 & 6
3000-3999	APL Color Bar (149A) APL Staircase (147A)	7 & 8
4000-4999	VITS & FF Logic	9 & 10
5000-5999	Genlock	11, 12, & 13
6000-6999	Function Gen	14 & 15
7000-7999	Output Amplifier	16 & 17
8000-8999	Modulator	18 & 19 (147A)
9000-9499	Controls	22
9500-9999	Power Supply	21

Waveforms. Important waveforms (typical) are given opposite the appropriate diagram in the Diagram section. These waveforms aid in determining if a circuit is functioning properly.

Wire Color Codes. All insulated wires in the 147A or 149A are color-coded to facilitate circuit tracing. Table 2-2 summarizes the coding system used in the instrument.

Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

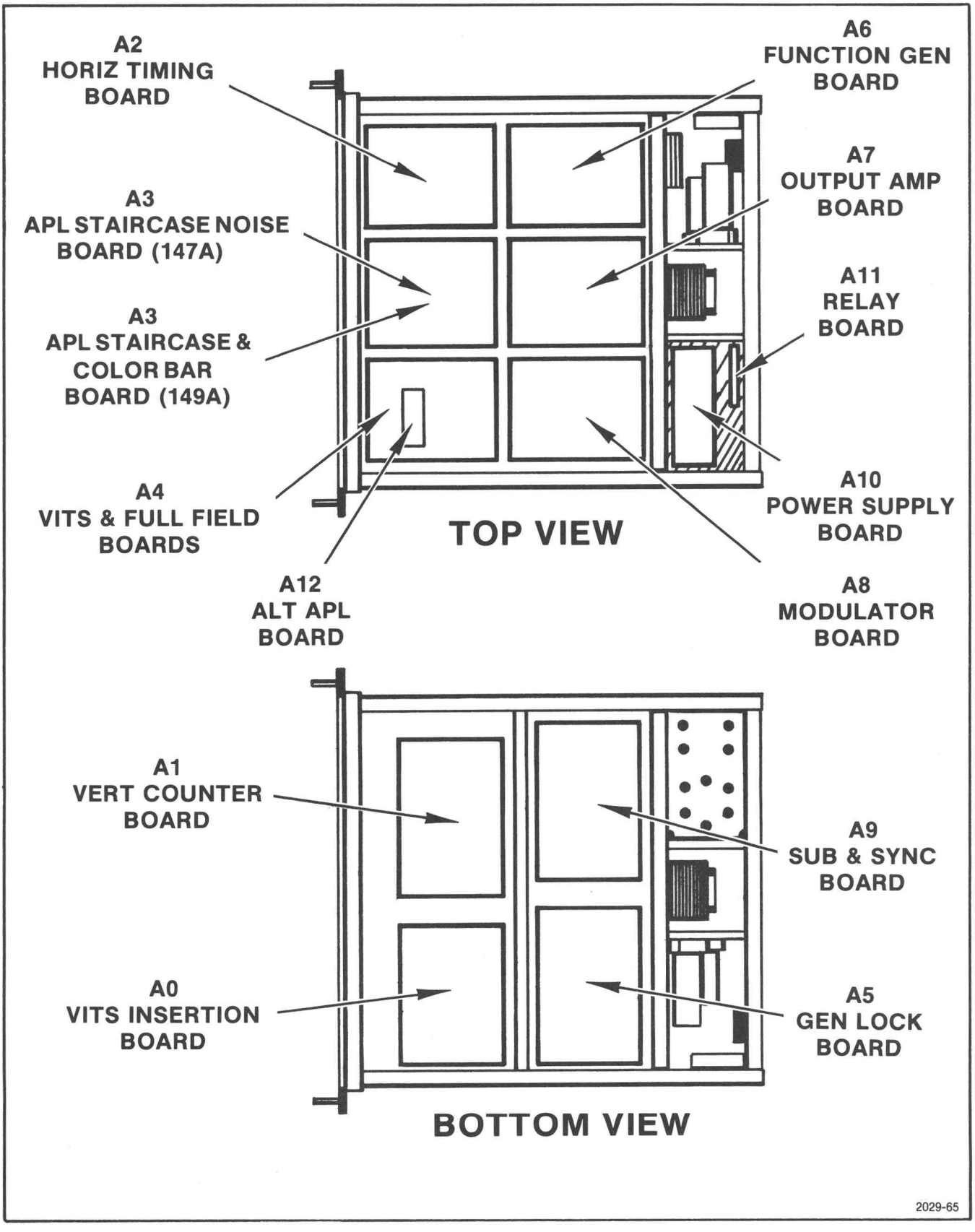


Fig. 2-1. Location of circuit boards.

TABLE 2-2

Color Code	Significance
Black	Chassis Ground
White on Black	Floating Ground
Yellow on Green	Safety Ground
Gray[1]	AC Line
White[1]	Signal
Red[2]	$+V_{cc}$
Violet[2]	$-V_{cc}$

Resistor Color Code. In addition to the brown composition resistors, metal film resistors (identified by their gray or light blue color) are used in the 147A or 149A. The resistance values of composition and metal film resistors are color-coded on the components with the standard EIA color code.

Capacitor Markings. The capacitance value of a common disc capacitor or small electrolytic is marked in microfarads on the side of the component body. The white ceramic capacitors used in the instrument are color-coded in picofarads using a modified EIA code. The new "tear drop" capacitors are color-coded in micofarads using a modified EIA code, with the dot indicating both temperature and the negative (−) side.

Troubleshooting Techniques

This troubleshooting procedure is arranged in an order which checks the simple possibilities before proceeding with extensive troubleshooting.

1. Check Control Settings. Incorrect control settings can indicate trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instructions.

2. Check Operation of Associated Equipment. Many times malfunction of equipment can be traced to associated equipment.

3. Visual Check. Visually inspect the portion of the instrument in which the trouble is located. Look for unsoldered connections, loose pin connectors, broken wires, damaged circuit boards, damaged components, etc.

[1]Color Stripes are used on these wires as an aid to circuit tracing.

[2]Color Stripe on wire indicates position of supply with respect to 0 volt (e.g., a black stripe on a red wire would be the first voltage in the positive direction). If a second stripe is used (white only), this indicates a non-regulated supply.

4. Check Circuit or Instrument Calibration. The apparent trouble may only be a result of misadjustment and may be corrected by calibration. Complete calibration instructions are given in this section.

5. Isolate Trouble to a Circuit. To isolate trouble to a circuit, note the trouble symptoms. The symptoms often identify the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check affected circuits by taking voltage and waveform readings.

Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltage of the individual supplies. A defective component elsewhere in the circuit can also appear as a power supply trouble, and affect the operation of other circuits.

The Circuit Description section of this manual can be used as a guide for isolating a trouble. This description explains how the various signal components are combined to form the video signal. By using the front-panel controls and checking the signals at the bnc connectors, it is possible to determine circuits that are functioning properly and those that are not.

When a trouble is isolated to the smallest possible area, proceed with steps 6 through 8 in this troubleshooting procedure to locate the defective component(s).

6. Check Circuit Board Interconnections. After the trouble has been isolated to a particular area or circuit, check the pin connectors on the circuit board for correct connection.

The pin connectors used in this instrument also provide a convenient means of circuit isolation. For example, a short in a power supply can be isolated by disconnecting the power distribution pin connectors for the voltage at the Power Supply board when making resistance to ground checks.

7. Check Voltage and Waveforms. Often the defective component can be located by checking for the correct voltage or waveform in the circuit. Typical voltages and waveforms are given in the Diagrams section.

NOTE

Voltages and waveforms given on the diagrams are not absolute and may vary slightly between instruments. To obtain operating conditions similar to those used to take these readings, see the back side of the Diagrams title page.

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CAUTION

Due to the component destiny on the circuit boards, care should be taken with meter leads and probe tips. Accidental shorts can cause abnormal voltage or transients which may destroy many components.

WARNING

"Ground lugs" are not always at ground potential. Check the diagrams before using such connections as a ground for the voltmeter test prod or oscilloscope probe. Some transistor cases may be elevated.

8. Check Individual Components. The following procedures describe methods of checking components in the 147A or 149A. Components which are soldered in place should be checked without removal, by isolating the component if circuit conditions allow. If component isolation is questionable unsolder one end.

a. Transistors. The best check of transistor operation is actual performance under operating conditions. If a transistor is suspected of being defective, it can best be checked by substituting a new transistor. However, be sure that circuit conditions are not such that a replacement might also be damaged. If substitute transistors are not available, use a dynamic tester such as the Tektronix Type 576.

b. Diodes. A diode can be checked for an open or shorted condition by measuring the resistance between terminals.

CAUTION

Do not use an ohmmeter range that has a high internal current. High current may damage some signal diodes. Never test tunnel diodes with an ohmmeter.

Repair and Readust the circuit. If any defective component or part is located, follow the replacement procedure given in this section. Be sure to check the performance of any circuit that has been repaired or that has had any electrical components replaced.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques or procedures required to replace components in this instrument are described here.

Obtaining Replacement Parts

All electrical and mechanical replacement parts for the 147A or 149A can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order from Tektronix, Inc. Before purchasing or ordering replacement parts, consult the Parts List for value, tolerance, and rating.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance at high frequencies.

Multiple Terminal Connector Holders. Most intercircuit connections between the circuit boards, or between the boards and chassis mounted components, are made through pin connectors. The terminals in the connector holder are identified with numbers. Connector orientation to the circuit board is keyed with triangles, one on the holder and one on the circuit board. See Fig. 2-2.

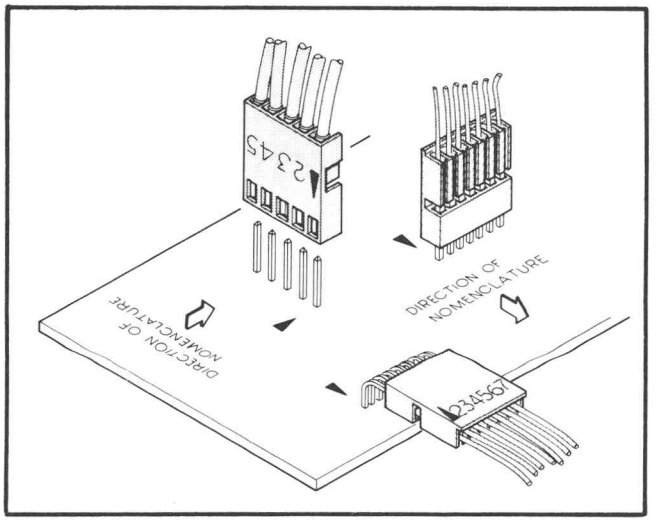


Fig. 2-2. Multipin circuit board connectors.

Circuit Boards. If the circuit board is damaged beyond repair, the entire assembly including all soldered-on components can be replaced.

Transistor and Integrated Circuit Replacement. Transistors and integrated circuits, (IC's) should not be replaced unless they are actually defective. Replacement or exchange of components may affect the calibration of the instrument. If a transistor or integrated circuit is removed during routine maintenance, return it to its original socket.

Any replacement component should be of the original type or a direct replacement. Bend the leads to fit the socket and cut the leads to the same length as on the component being replaced. See Fig. 2-3 for basing diagrams.

The chassis-mounted power supply transistors and their mounting bolts are insulated from the chassis. In addition, silicone grease is used to increase heat transfer capabilities. Re-install the insulators and replace the silicone grease when replacing these transistors. The grease should be applied to both sides of the mica insulators, and should be applied to the bottom side of the transistor where it comes in contact with the insulator.

WARNING

Voltages are present on the exterior surface of the chassis-mounted power supply transistors if applied to the instrument and the POWER switch is on.

After any component is replaced, check the operation and calibration of the associated circuits.

Indicator Lamp Replacement. To remove the POWER ON indicator lamp, remove the top dust cover from the instrument, then reach behind the front-panel and unplug the lamp from its socket. To replace the lamp, reverse the procedure.

The NONSYNCHRONOUS MODE/NO VITS, PROGRAM, PREVIEW, VIRS INCOMING, VIRS INSERT, and VIRS DELETE indicators consist of two parts: a lens that is attached to the instrument, and a lens cap (connected to the back of the lens) into which the lamps have been soldered. To remove the lamps, reach behind the front-panel, grasp the lens cap and pull straight away from the front panel. The lens cap will unsnap from the lens, allowing lamp access. Unsolder the lamp. To replace, solder the new lamp into the lens cap. Then place the lens cap on the back of the lens and apply enough pressure to snap the cap into place over the lens.

Fuse Replacement. Both line fuses are contained in plastic holders in the cover for the Line Voltage Selector Assembly at the rear of the instrument. Use only the correct value replacement fuse. Only the upper fuse within the assembly (3/4 A) is used for 115-volt operation. However, for 230-volt operation both the upper and lower fuse (1/2 A) must be installed.

Switches. If a switch is defective, replace the entire assembly. Replacement switches can be ordered by referring to the Parts List for the applicable part numbers.

Power Transformer Replacement. If the power transformer becomes defective, contact your local Tektronix Field Office or representative for replacement. Replace only with a direct replacement Tektronix transformer.

Power Input Connector and RFI Filter Replacement. The Power Input Connector and RFI Filter is replaceable as a unit and repair should not be attempted. If replacement is necessary, observe proper polarity to assure instrument protection.

The narrow blade (terminal number 4) should show continuity to terminal number 3, which connects to fuse F9201, see diagram 21. (The filter contains an internal non-replaceable fuse between these two terminals.) Use care when soldering to terminals numbers 1 and 3, as excess solder chould possibly short the filter case.

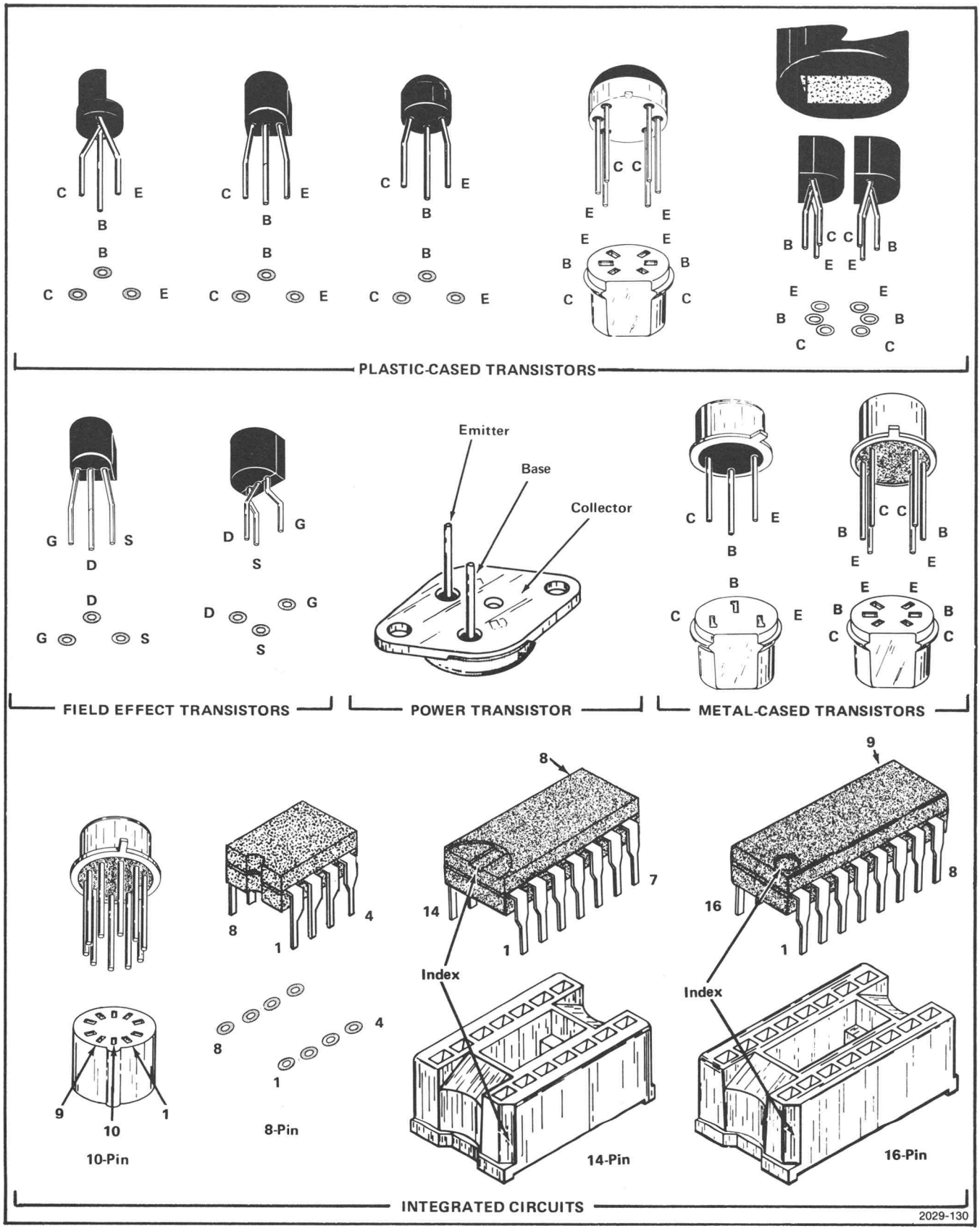
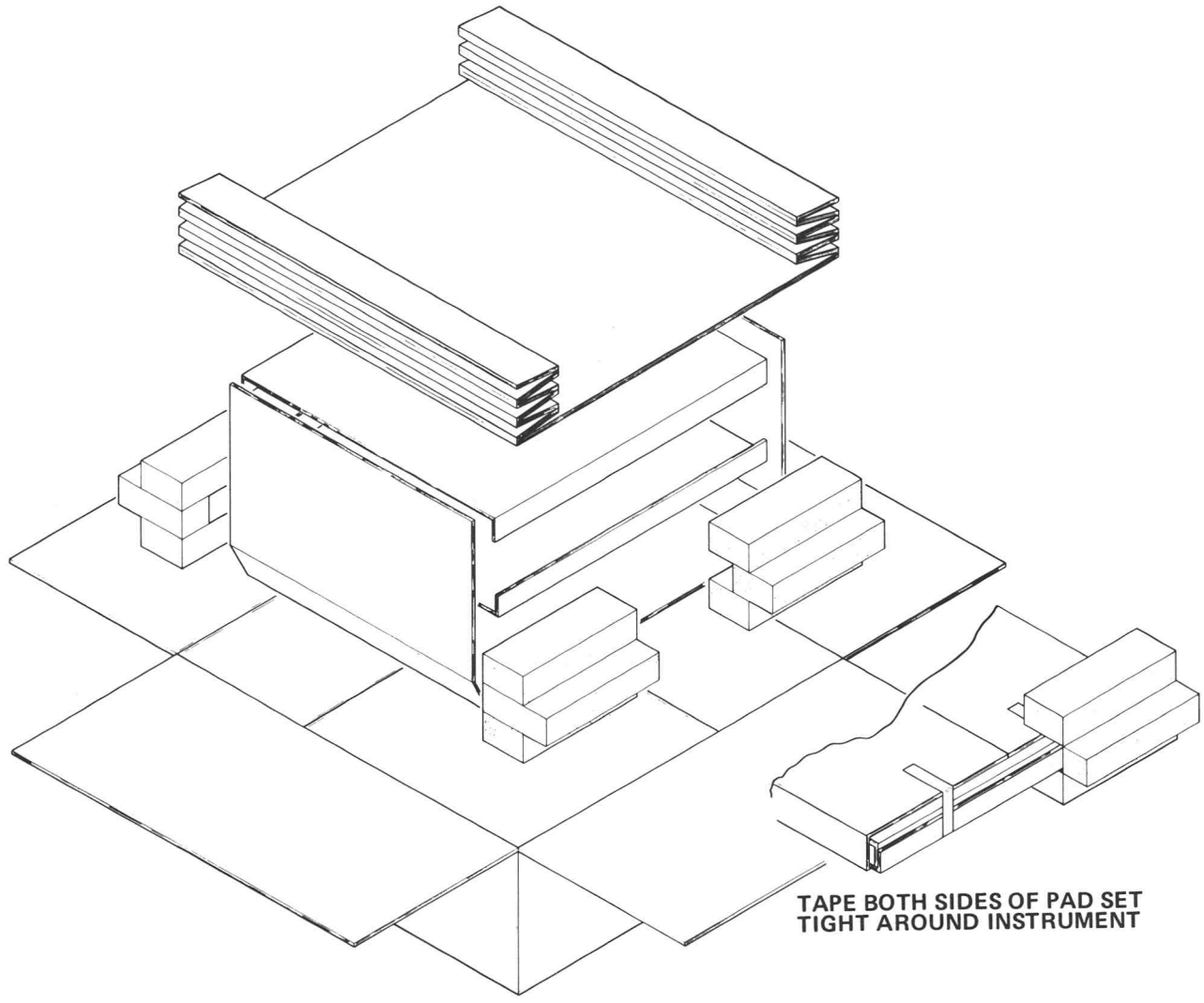


Fig. 2-3. Transistor and Integrated Circuit basing diagrams.



Repackaging for Shipment:

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted, complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

1. Obtain a carton of corrugated cardboard having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Refer to Table 1 for carton test strength requirements.
2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.
4. Seal carton with shipping tape or industrial stapler.

Table 1. Shipping Carton Test Strength.

Gross Weight (lb.)	Carton Test Strength (lb.)
0 – 10	200
10 – 30	275
30 – 120	375
120 – 140	500
140 – 160	600

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Fig. 2-4. Repackaging instructions.

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CALIBRATION PROCEDURE

General

The calibration procedure is arranged in a sequence designed for calibration with minimum interaction of adjustments and reconnection of equipment. However, some adjustments affect the calibration of other circuits, and it may be necessary to check the operation of other parts of the instrument. Where adjustments interact, they are noted.

The procedure uses the equipment and fixtures listed in the Test Equipment list. If test equipment is substituted for that on the list, control settings, setups, and methods of measuring may have to be altered.

The 147A and 149A front- and rear-panel control titles and signal output connectors are capitalized (i.e., COMP SYNC). Internal adjustment titles are initial capitalized only (i.e., Subcarrier Ampl.).

Test Equipment

All test equipment is assumed to be correctly calibrated and operating within the given specifications.

1480 Option 1 Waveform Monitor

This calibration procedure uses a Tektronix 1480 Option 1 Waveform Monitor for most amplitude and timing checks and adjustments. The probe input of the Option 1 allows this waveform monitor to be used in many applications where a test oscilloscope would ordinarily be used. The NTSC graticule is calibrated in IRE units (140 IRE = 1 Volt). The graticule is divided into major divisions representing 10 IRE each at 1 Volt Full Scale, and minor divisions representing 2 IRE each at 1 Volt Full Scale. Conversion from each major and minor division into IRE/Division and mV/Division is as follows:

Volts Full Scale	IRE/Division		mV/Division	
	Major	Minor	Major	Minor
1.0	10	2	71.4	14.3
0.5	5	1	35.7	7.1
0.2	2	0.4	14.3	2.9

Timing is directly readable by the front-panel controls and the graticule horizontal timing marks. The controls read in μs/Div, meaning each major horizontal division is equal to whatever the Mag or Display switch is set to. The Mag switch will override the Display switch in 10 μs/Div and 5 μs/Div.

In the 2 Field Display position, each major division is equal to 2.627 ms, and each minor division is equal to 525 μs. When the Mag switch is on, the above values should be divided by the magnification power to determine the appropriate time/division.

Calibration Fixture

A calibration fixture used with the 1480 Waveform Monitor provides a variable calibrator level which can be read directly from a 10-turn dial. The schematic diagram and parts list for the fixture appear in Fig. 3-1. When S1 is in the Fixed position, the 1480 calibrator voltage is determined by the internal calibrator circuit. When S1 is in the Variable position, the calibrator voltage is determined by the circuit in the fixture.

With P9034 connected to J9034 on the 1480, and S1 in the Fixed position, calibrate the graticule for 100 IRE (714.3 mV). Set the Amplitude dial for 714.3, and S1 to Variable. Adjust R3 (Cal), to exactly match the internal 714.3 mV calibrator level. The dial is now calibrated so that each turn of the dial represents 100 mV.

Measurements

The signal to be measured must be fed to the 1480 Ch. A Input, and both the Oper and Cal buttons pushed. To check luminance amplitudes within a given tolerance, adjust the Amplitude dial while watching the waveform monitor display. When the level being measured overlays the blanking level, read the amplitude directly from the dial.

Peak-to-peak chrominance amplitudes can be checked for tolerance by adjusting the dial until the peaks of the chrominance packet being measured just meet.

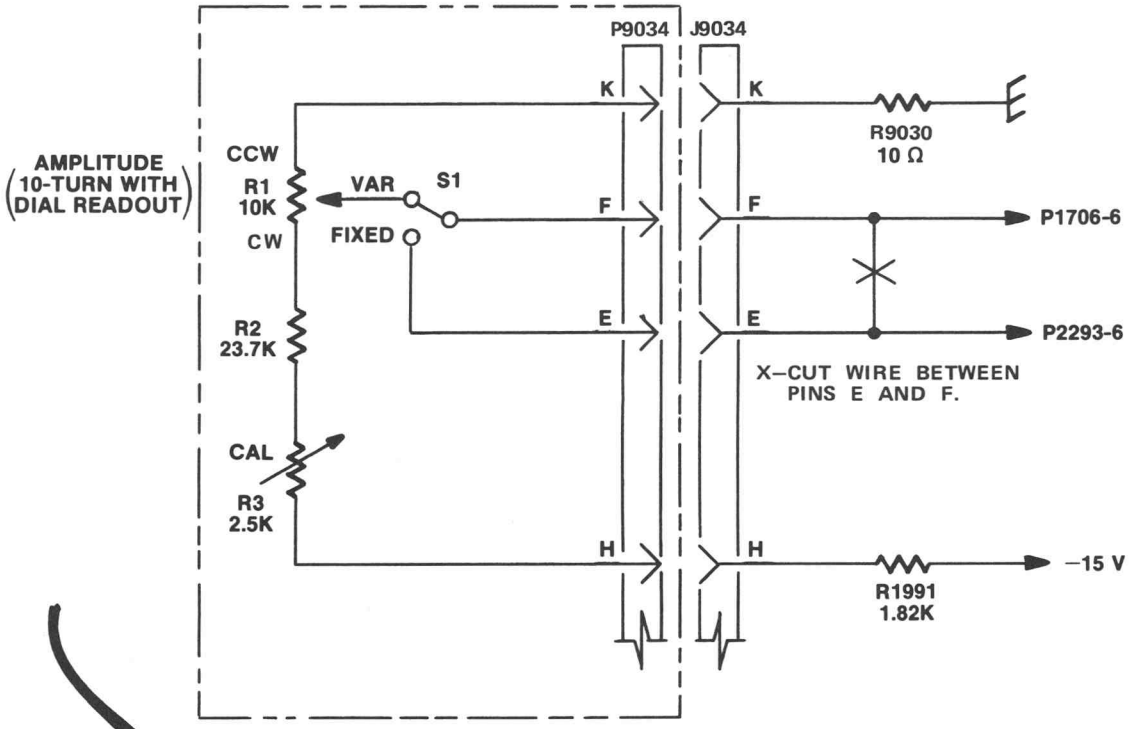
To adjust a signal level, use the calibration fixture as a reference. First, set the Amplitude dial to the desired level. Then, for luminance signals, adjust the required control so the luminance level overlays the blanking level. For chrominance, adjust for the peaks to just meet.

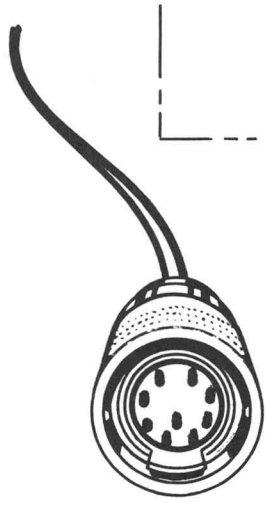
Using The Spectrum Analyzer

Connect the 147A or 149A front-panel FULL FIELD SIG OUT to the input of a Tektronix 1401A Spectrum Analyzer (or equivalent). Connect the 1401A Video Out to the 1480 B Input. Connect the 1401A Sweep Voltage (5 V) to the 1480 External Horizontal Input (check the 1480 Instruction

CALIBRATION FIXTURE

1480 REAR PANEL





P9034
REAR VIEW

J9034
REAR VIEW



PARTS LIST

Ckt No.	Description	TEKTRONIX p/n
P9034	9-pin Amphenol #165-13	134-0049-00
R1	10 kΩ ±5%, Ind. Lin. ±0.1%, 10-turn 10-turn prec. var.	311-1729-00
R2	23.7 kΩ ±1%, 1/8 W, metal film	321-0325-00
R3	2.5 kΩ ±20%, Cermet var.	311-1561-00
S1	SPDT Toggle switch	260-0613-00
	10-turn dial for R1, Kilo-dial Mod. 461-S-41	331-0139-00
Misc.	Approx. 3 ft. of 4-conductor cable, small piece of Vectorboard, and a small metal or plastic enclosure or case.	

Set R1 fully counterclockwise (ccw) and the dial at 0 when installing.

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Fig. 3-1. 1480 Test Fixture schematic and parts list.

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Manual for any special instructions on operating the External Horizontal function). Set the 1480 for 1.0 Volt Full Scale and Ext Display. Set up the 1401A as follows:

Power	On
RF Atten dB	20
IF Gain	ccw
Vertical Display	Log
Center Freq MHz	
1-500	000
Fine	0
Sweep Mode	Free Run
Sweep Rate	10 o'clock
Resolution kHz	100
Freq Span	
MHz/Div	.5
Var (Cal In)	pushed in
Video Filter	Off

Allow a 20 minute warmup time for the batteries to charge on the 1401A.

To determine the −40 dB point, set the 1401A RF Atten to 10 dB, and adjust the IF Gain cw until the Multiburst frequencies are of maximum amplitude. Adjust the 1480 Var Volts Full Scale for 6 major divisions of signal. Set the 1401A RF Atten to 60 dB. Position the peaks of the Multiburst frequencies to the horizontal reference graticule line on the 1480. Set the 1401A back to 20 dB. Any signal over the reference line is greater than −40 dB in amplitude.

Test Equipment for Adjustment Steps

1. Waveform Monitor. Tektronix 1480 Option 1 Waveform Monitor (SN B02960 or above). If a 1480-Series monitor is not available, a test oscilloscope with differential inputs, and the Chopped Voltage Reference listed in the optional test equipment list should be used.

2. Test Fixture for 1480. Constructed by user (see Fig. 3-1).

3. Vectorscope. Tektronix 520A NTSC Vectorscope or equivalent.

4. Video Signal Source. Signals: NTSC color bars or modulated staircase (5 steps and 140 mV subcarrier) and VITS insertion; composite sync, and subcarrier. Tektronix 140 NTSC Test Signal Generator or equivalent.

5. DC Voltmeter. Capable of measuring 5 and 15 volts within 1%. Tektronix DM 501 or equivalent.

6. Coaxial Cables (7). 75 Ω with BNC connectors. Tektronix Part No. 012-0074-00 or equivalent.

7. Terminations (3). 75 Ω end-line, with BNC connectors. Tektronix Part No. 011-0102-00 or equivalent.

8. Spectrum Analyzer. Center frequency, 0.1 MHz; resolution, 100 kHz; frequency span, at least 2 MHz/Div; RF attenuation range, capable of measuring 40 dB below the reference signal. Tektronix 1401A or equivalent.

9. RMS Voltmeter (required for 147A, optional for 149A). Must be capable of measuring −20 dB to −75 dB from 700 mV within 1 dB. Hewlett-Packard Model 3400A or equivalent.

10. Low-Pass Filter (required for 147A, optional for 149A). Noise Measurement Low-Pass Filter. $F_c = 4.2$ MHz. Tektronix Calibration Fixture 015-0212-00 or equivalent.

Optional Test Equipment

1. Variable Autotransformer. Power supply regulation. Capable of supplying at least 200 volt-amperes over the desired line voltage range. General Radio W10MT3W Metered Variac Autotransformer or equivalent.

2. Test Oscilloscope. Bandwidth, dc to at least 30 MHz; minimum deflection factor, 1 mV/division; two input channels capable of independent or differential operation; time base, at least 0.1 μs/division and slower. Tektronix 7603 Oscilloscope with 7A13 and 7B53A plug-ins or equivalents.

3. Chopped Voltage Reference. Tektronix Calibration Fixture 067-0596-00 (chopper) or equivalent. Use with test oscilloscope if a 1480-Series Waveform Monitor is not available (carefully follow the instruction manual to determine the correct voltage being measured).

4. Sinewave Generator. Return loss and frequency response. Output of at least 500 mV; frequency range, 50 kHz reference and variable from 1 MHz to 6 MHz. Tektronix SG 503 Leveled Sinewave Generator or equivalent (signal generator).

5. Return Loss Bridge. Use with differential amplifier and signal generator. Tektronix Part No. 015-0149-00.

6. Minimum Loss Attenuator, 50 Ω to 75 Ω. Use with spectrum analyzer and signal generator. Tektronix Part No. 011-0057-00.

7. RMS Voltmeter. Capable of measuring −20 dB to −75 dB from 700 mV within 1 dB. Hewlett-Packard Model 3400A or equivalent.

8. Low-Pass Filter. Program Line Out aberrations. F_c = 5 MHz. Tektronix Calibration Fixture 015-0213-00.

9. Noise Weighting Filter. F_c = 5 MHz. Tektronix Calibration Fixture 015-0215-00.

PRELIMINARY Setup

1. Install the rear-panel REMOTE plug P9014. Allow a ten minute warmup at 25°C ±5°C before checking or calibrating the instrument.

2. Set the 147A or 149A switches to the up position, except:

PROGRAM CONTROL	LOCAL
FULL FIELD SIG	
Selector	FLAT FIELD
Mode	NORMAL
APL	VARIABLE
VARIABLE	100 IRE
COLOR TEST SIGNAL (149A only)	
COLOR BARS	FULL FIELD
NOISE AND PEDESTAL (147A only)	
NOISE LEVEL dB	OFF
MULTIBURST AMPLITUDE (149A only)	FULL

3. Connect an external 2-volt peak-to-peak composite video signal to the 147A or 149A PROGRAM LINE IN.

NOTE

Unless otherwise noted, connections made to the 147A and 149A are via a 75 Ω coaxial cable.

4. From the 147A or 149A rear-panel FULL FIELD TEST SIGNAL output connector, connect a cable to the monitor A Input; loop-through with another cable, to the vectorscope A Input; terminate the vectorscope loop-through with a 75 Ω end-line termination.

5. Connect the video signal source composite sync signal to the waveform monitor Ext Sync input; connect the loop-through, with another cable, to the vectorscope Ext Sync input; terminate the vectorscope loop-through with a 75 Ω end-line termination.

6. Connect the video signal source subcarrier to the vectorscope Ext Ø Ref input; terminate the vectorscope loop-through with a 75 Ω end-line termination.

GROUP 1—INITIAL

NOTE

Do not adjust the power supplies if they are within the listed tolerances. Adjustment of any supply will affect the operation of other circuits within the instrument. If a complete recalibration is being performed, set each voltage to the exact setting.

1. Check/Adjust Power Supply Voltages

Connect a precision dc voltmeter between chassis ground (pin 1 of P9834) and P9852 (−15 V), see Fig. 3-2.

CHECK—Voltage should be −15 V within 1% (−14.85 to −15.15 V).

ADJUST—R9851 (−15 Volt Adj) for −15 V.

Connect the voltmeter between chassis ground and P9832 (+15 V).

CHECK—Voltage should be +15 V within 1% (14.85 to 15.15 V).

ADJUST—R9831 (+15 Volts Adj.) for +15 V.

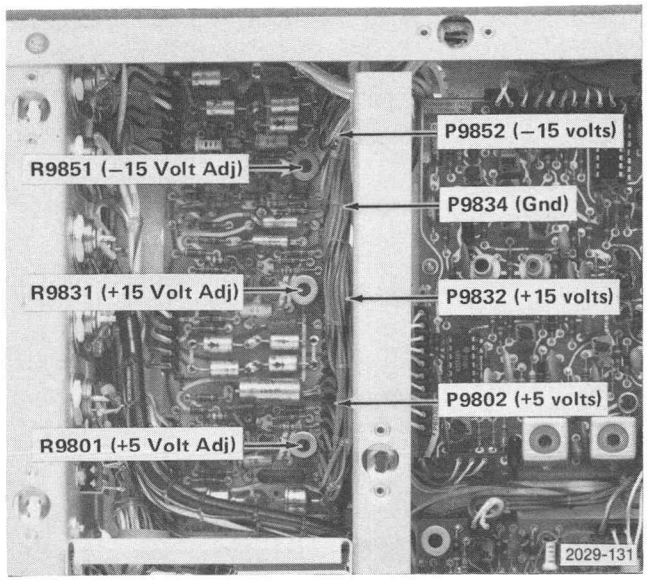


Fig. 3-2. Power Supply test point and adjustment locations.

Connect the voltmeter between chassis ground and P9082 (+5 V).

CHECK—Voltage should be +5 V within 1% (4.95 to 5.05 V).

ADJUST—R9801 (+5 Volts Adj) for +5 V.

Repeat the above adjustments to remove any interaction.

2. Check Power Supply Ripple

Use a 1X probe between the supply under test and the test oscilloscope.

CHECK—Power-line related ripple at these plugs:

Plug	Supply	Max Ripple
P9852	−15 V	10 mV
P9832	+15 V	10 mV
P9802	+5 V	10 mV

3. Check/Adjust 1 MHz Oscillator Lock

Establish a 0-volt (ground) reference point on the test oscilloscope. Connect a 10X probe to TP1730, See Fig. 3-3.

CHECK—Display dc level should be approximately +2.5 V.

ADJUST—L1670 (1 MHz Osc) to position the display midway between the two levels at which the oscillator free-runs (one level near +5 V dc and the other near 0 V dc).

4. Check/Adjust INSERT DELAY Range

Connect the 10X probe to the back of the FULL FIELD TEST SIGNAL OUT connector. Display the full-field signal and establish a horizontal timing reference point.

CHECK—Rotation of the INSERT DELAY control, through its range, should move the display 1 μs or more.

ADJUST—INSERT DELAY control to electrical midrange.

5. Check/Adjust Subcarrier Amplitude

Display the CW SUBCARRIER OUT on the test oscilloscope.

CHECK—Subcarrier amplitude should be between 1.8 and 2.2 V peak-to-peak.

ADJUST—L190 (Subcarrier Ampl), see Fig. 3-4, for a subcarrier amplitude of 2 V peak-to-peak.

6. Check/Adjust Composite Sync

Display the COMP SYNC on the test oscilloscope.

CHECK—Composite Sync amplitude should be between 3.6 V to 4.4 V (4 V ±10%) negative going.

CHECK—Aberrations on leading corner of the sync should be 4%, or less, of the total amplitude.

ADJUST—L20 and L120 (Sync Filter), see Fig. 3-4, for the best square corner on the leading edge of sync with aberrations 4% or less.

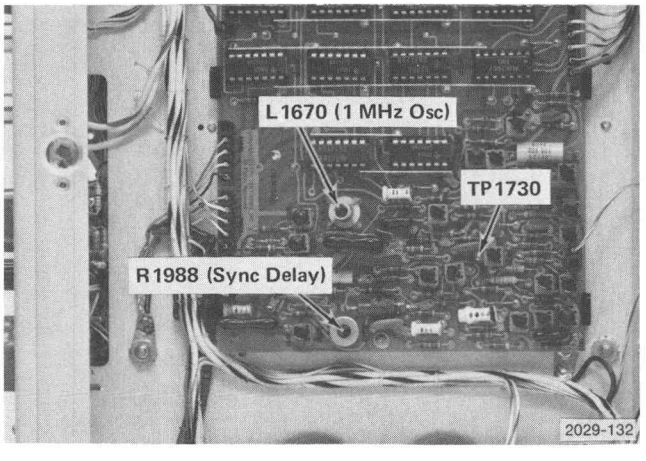


Fig. 3-3. Horizontal Counter test point and adjustment locations.

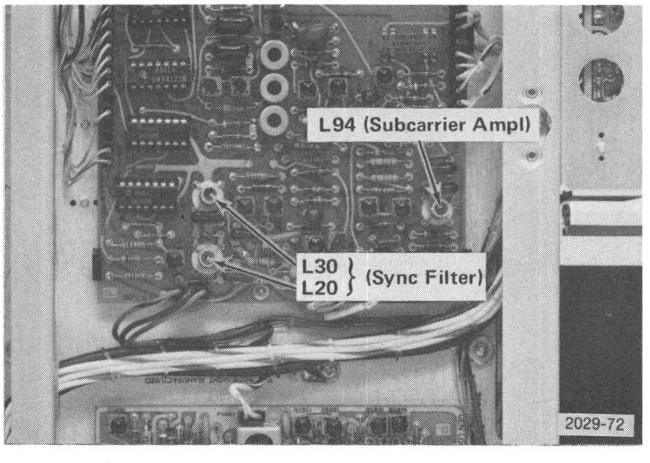


Fig. 3-4. Subcarrier & Sync filter adjustment locations.

GROUP 2—OUTPUT AMPLITUDES

1. Setup

Display the rear-panel FULL FIELD TEST SIGNAL on the A Input of the 1480 Waveform Monitor. Set the Waveform Monitor for Ch. A, DC Cpl'd, 0.2 Volt Full Scale, 10 μs/Div, Mag off, all grey pushbuttons in, except DC Restorer is Off, and Waveform Comparison Off. Position the blanking level to midscreen.

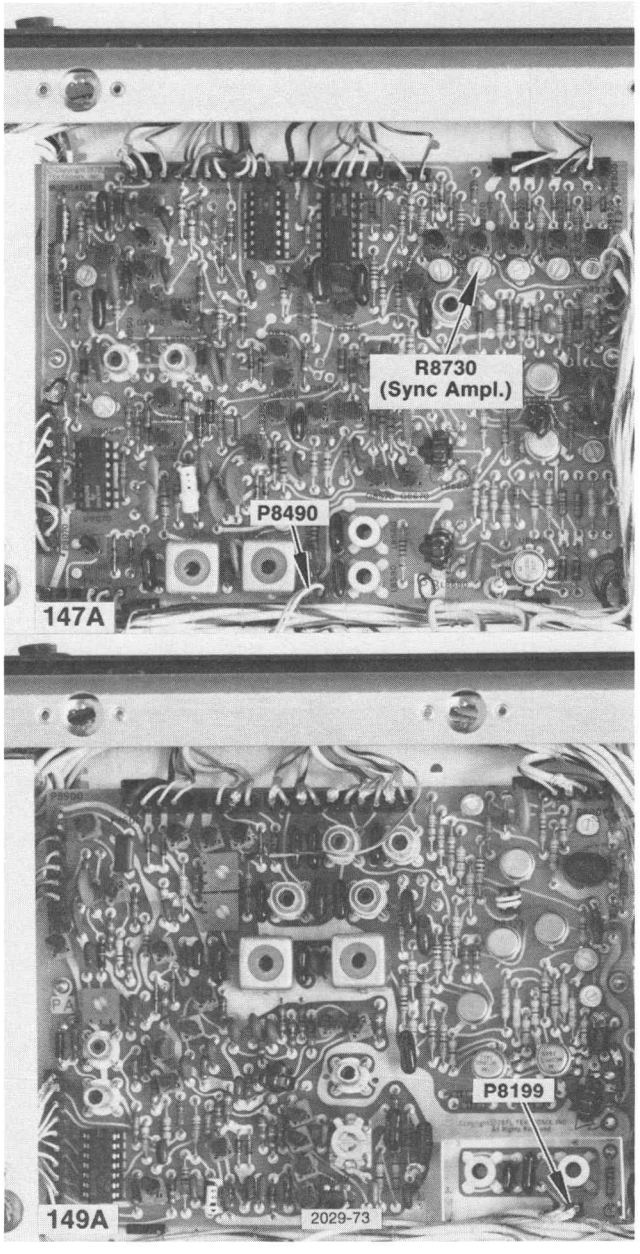


Fig. 3-5. 147A Modulator circuit board locations of P8490 and Sync Ampl. adjustment, and 149A Modulator circuit board showing the location of P8199.

Disconnect P8490 of the 147A or P8199 of the 149A (see Fig. 3-5) to remove chrominance from the signal during this part of the procedure.

Push the Back Porch DC Restorer button (714 mV Cal squarewave), and both the Oper and Cal buttons. Position the display to show the pedestal and the blanking level, overlayed. (See Fig. 3-6).

2. Check/Adjust Pedestal Amplitude

CHECK—Pedestal matches the blanking level within 2.5 minor divisions (100 IRE within 1 IRE).

ADJUST—R7735 (Reference Ampl), see Fig. 3-7, so the pedestal exactly overlays the blanking level (100 IRE).

3. Check/Adjust Sync Amplitude (147A)

Push the 1480 Sync Tip DC Restorer button (1 V Cal squarewave). Position the display to show the overlayed sync tip and pedestal (see Fig. 3-8).

CHECK—Sync and pedestal overlays within 2.5 minor divisions (−40 IRE within 1 IRE).

ADJUST—R8730 (Sync Ampl), see Fig. 3-5, so the sync and pedestal exactly overlay (−40 IRE).

Check/Adjust Sync Amplitude (149A)

Push the 1480 Sync Tip DC Restorer button (1 V Cal). Position the display to show the overlayed sync tip and pedestal (see Fig. 3-8).

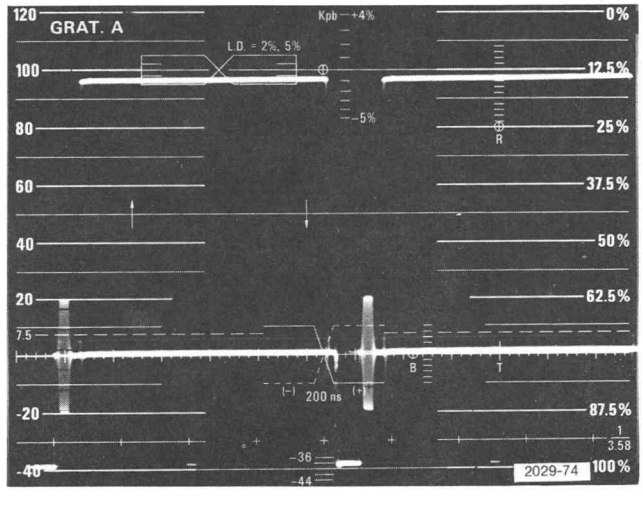


Fig. 3-6. Waveform showing 100 IRE pedestal overlaying the blanking level (signals offset 100 IRE).

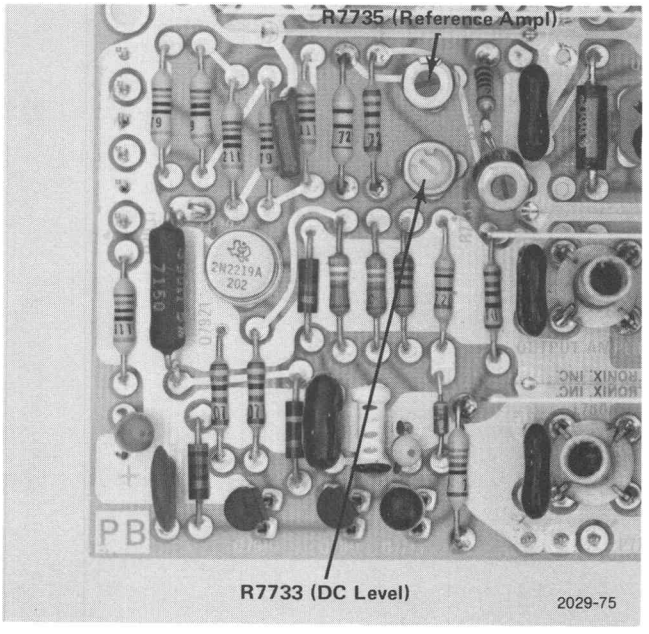


Fig. 3-7. Output Amplifier adjustment locations.

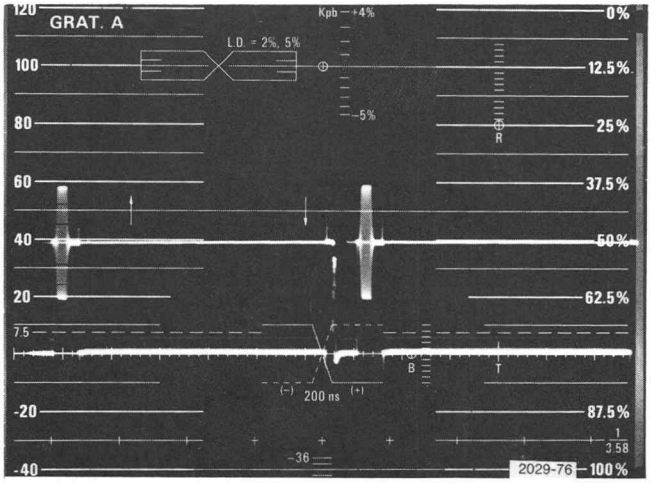


Fig. 3-8. Waveform showing Sync tip overlaying 100 IRE pedestal (140 IRE offset).

CHECK—Sync and pedestal overlay within 2.5 minor divisions (−40 IRE within 1 IRE).

ADJUST—R455 (Sync Ampl, see Fig. 3-9) so the sync and pedestal exactly overlay (−40 IRE).

4. Check/Adjust Output DC Level

Push just the 1480 Oper button. Disconnect the FULL FIELD TEST SIGNAL temporarily. Set the 1480 Vertical Position to establish a ground reference on a horizontal graticule line. Reconnect the 147A or 149A to the A Input.

CHECK—Blanking level is at the ground reference line within 3.5 major divisions (0 volt within 50 mV).

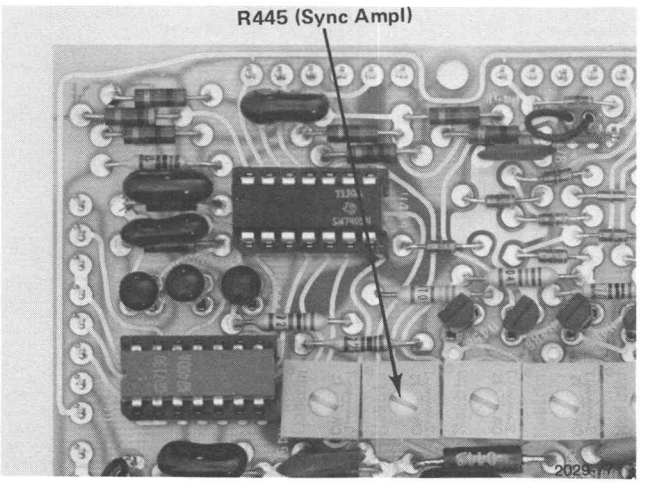


Fig. 3-9. 149A Subcarrier & Sync circuit board showing Sync Ampl. adjustment.

ADJUST—R7733 (DC Level, see Fig. 3-7) to position the blanking level to the ground reference line (0 volt).

5. Calibration Test Fixture (See Fig. 3-1)

Push the Back Porch DC Restorer button (714 mV Cal), and both the Oper and Cal buttons on the 1480. Set the Test Fixture Amplitude dial to 714.3 mV.

CHECK—The displayed signal does not change level when S1 is switched between Fixed and Variable.

ADJUST—R3 (Cal Adjust) on the Test Fixture so that the displayed signal level does not change when S1 is switched between Fixed and Variable.

Leave S1 set to Variable.

6. Check FULL FIELD SIGNAL Outputs

Display the front-panel FULL FIELD TEST SIGNAL OUT on the 1480 Waveform Monitor. Set the Amplitude dial to overlay the pedestal and blanking level.

CHECK—The Amplitude dial reads between 707.2 mV and 721.4 mV (100 IRE within 1 IRE).

Return the rear-panel FULL FIELD TEST SIGNAL OUT to the A Input of the 1480. Set the 1480 for 1.0 Volt Full Scale.

7. Check Full Field Signal Timing

Reconnect P8490 (147A) or P8199 (149A) for this step only.

Using Fig. 1-9 of this manual as a guide, check that each full-field signal generated by the 147A or 149A is horizontally timed as shown.

GROUP 3—LUMINANCE

1. Check FLAT FIELD VARIABLE APL Linearity

Push both the Oper and Cal buttons on the 1480. Using the 1480 Test Fixture and Table 3-1, note the amplitude of each APL pedestal and determine the difference amplitude between each increment.

CHECK—Each 10 IRE increment of the VARIABLE APL pedestal is equal in amplitude within 2% (10 IRE within 2%).

TABLE 3-1

% APL	Approx. Dial Setting	Change from Previous Setting
0	0	
10	71.4 mV	70-73 mV
20	142.9 mV	70-73 mV
30	214.3 mV	70-73 mV
40	285.7 mV	70-73 mV
50	357.1 mV	70-73 mV
60	428.6 mV	70-73 mV
70	500.0 mV	70-73 mV
80	571.4 mV	70-73 mV
90	642.9 mV	70-73 mV
100	714.3 mV	70-73 mV

2. Check BOUNCE Signal

Set the APL switch to BOUNCE 10-90, and the RATE control to maximum CW.

CHECK—BOUNCE APL changes between two levels:

Bottom level 57.1 mV to 85.7 mV (10 IRE within 2 IRE).

Top level 628.6 mV to 657.2 mV (90 IRE within 2 IRE).

Push the 1480 Oper button. Using the second hand on a watch or clock:

CHECK—BOUNCE signal changes at a rate of approximately once per second.

Set the BOUNCE RATE control to maximum CCW.

CHECK—BOUNCE switching occurs at 10 second or longer intervals.

Return the BOUNCE RATE control to maximum CW.

(149A only) Set the 1480 to a 2 Field Display rate.

CHECK—BOUNCE switching occurs at line 57.

NOTE

When P3926 pins 1 and 2 are connected on the 149A, switching occurs at random points in the field.

3. Check FIELD SQ. WAVE Test Signal

Set the FULL FIELD SIG selector switch to FIELD SQ. WAVE.

CHECK—The duration of the pedestal is from line 57 through line 227 in each field.

Set the 1480 for a 10 μs/Div Display rate, and push both the Oper and Cal buttons.

CHECK—Pedestal amplitude is between 700.0 mV and 728.6 mV (100 IRE within 2 IRE).

4. Check NOISE Pedestal Amplitudes (147A Only)

Set the FULL FIELD SIG selector switch on the 147A to NOISE.

CHECK—Pedestal amplitudes selected by the PEDESTAL switch are as follows:

Pedestal	Amplitude
100 IRE	707.2 mV to 721.4 mV (100 IRE within 1 IRE)
50 IRE	350.0 mV to 364.3 mV (50 IRE within 1 IRE)
10 IRE	70.0 mV to 72.9 mV (10 IRE within 0.2 IRE)

Set the 147A Noise switch to INSERTION (HALF LINE).

CHECK—The VARiable PEDESTAL control changes the amplitude of each pedestal at least ±10 IRE around the nominal amplitude.

Pedestal	Amplitude Range
100 IRE	642.9 mV to 785.7 mV (90 IRE to 110 IRE)
50 IRE	285.7 mV to 428.6 mV (40 IRE to 60 IRE)
10 IRE	0.0 mV to 142.9 mV (0 IRE to 20 IRE)

Return the NOISE and PEDESTAL switches to DELETION (FULL LINE) and 100 IRE PEDESTAL.

5. Check/Adjust MULTIBURST Pedestals

Set the 147A or 149A FULL FIELD SIG selector switch to MULTIBURST. Set R6938 (see Fig. 3-10) fully cw. Set the 1480 to a 2 Field Display rate.

CHECK—Horizontal and vertical blanking levels are matched.

ADJUST—R6942 (MB Sync Level, see Fig. 3-10) so the horizontal and vertical blanking levels are matched.

Set the 1480 for a 10 μs/Div Display Rate. Push both the Oper and Cal buttons.

CHECK—The MB White Reference Flag amplitude is between 707.2 mV and 721.4 mV (100 IRE within 1 IRE).

ADJUST—R6833 (MB Pedestal Amplitude) for a MB White Reference Flag amplitude of exactly 714.3 mV (100 IRE).

CHECK—The MB center level is between 385.7 mV and 400.0 mV (55 IRE within 1 IRE).

ADJUST—R6836 (MB Center Level, see Fig. 3-10) for a MB center level of exactly 392.9 mV (55 IRE).

Set the MULTIBURST AMPLITUDE switch to REDUCED (147A) or 60 IRE (149A).

CHECK—Center level amplitude is between 278.6 mV and 292.9 mV (40 IRE within 1 IRE).

Return the MULTIBURST AMPLITUDE switch to NORMAL (147A) or FULL (149A).

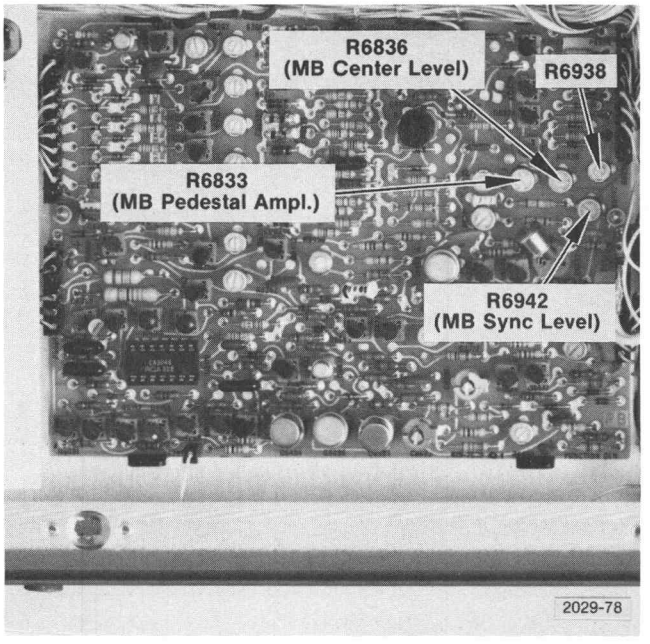


Fig. 3-10. Function Generator circuit board showing MULTIBURST luminance adjustments.

6. Check/Adjust LINEARITY Amplitudes

Set the FULL FIELD SIG selector switch to LINEARITY.

CHECK—Peak LINEARITY amplitudes are as follows:

Signal	Amplitude
LINEARITY	
RAMP	635.7 mV to 650.0 mV (90 IRE within 1 IRE)
10 STEPS	635.7 mV to 650.0 mV (90 IRE within 1 IRE)
5 STEPS (147A)	635.7 mV to 650.0 mV (90 IRE within 1 IRE)
5 STEPS (149A)	564.3 mV to 578.6 mV (80 IRE within 1 IRE)

ADJUST—Peak LINEARITY amplitudes as follows (see Fig. 3-11 for adjustment locations):

Signal	Adjust	Amplitude
LINEARITY		
RAMP	R3616 (Ramp Ampl)	642.9 mV (90 IRE)
10 STEPS	C3470 (10 Step Ampl)	642.9 mV (90 IRE)
5 STEPS (147A)	C3565 (5 Step Ampl)	642.9 mV (90 IRE)
5 STEPS (149A)	C3565 (5 Step Ampl)	571.4 mV (80 IRE)

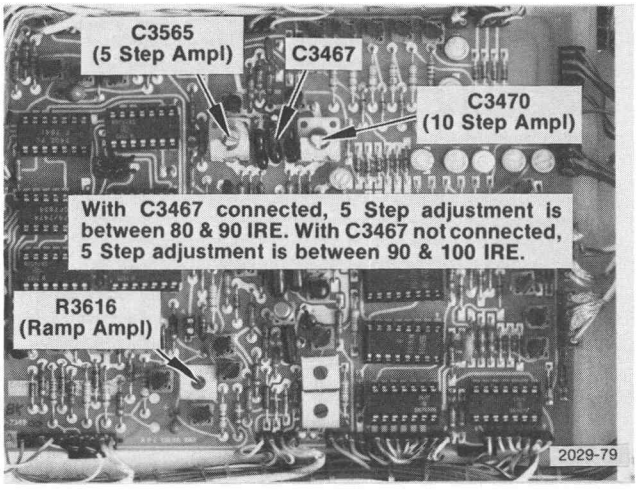


Fig. 3-11. Staircase and APL circuit board locations of LINEARITY adjustments.

7. Check/Adjust Bar Amplitude

Set the FULL FIELD SIG selector switch to COMPOSITE.

CHECK—Bar amplitude at the center portion is between 707.2 mV and 721.4 mV (100 IRE within 1 IRE).

ADJUST—R7143 (Bar Amplitude), see Fig. 3-12, for the amplitude at the center portion of the Bar to be exactly 714.3 mV (100 IRE).

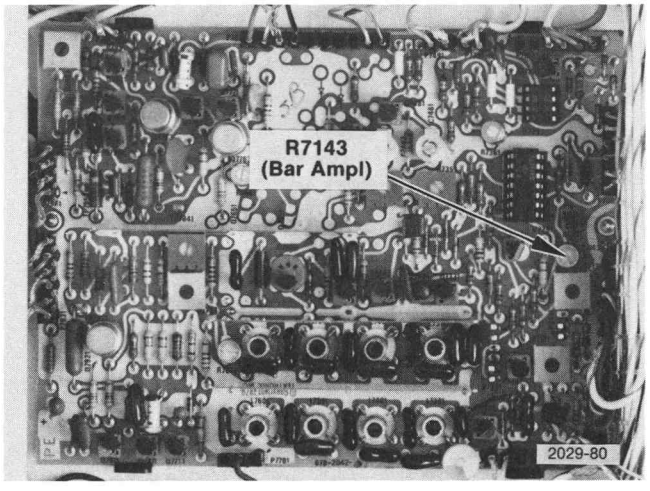


Fig. 3-12. Output Amplifier circuit board showing location of Bar adjustment.

8. Check/Adjust VIRS Luminance Amplitudes

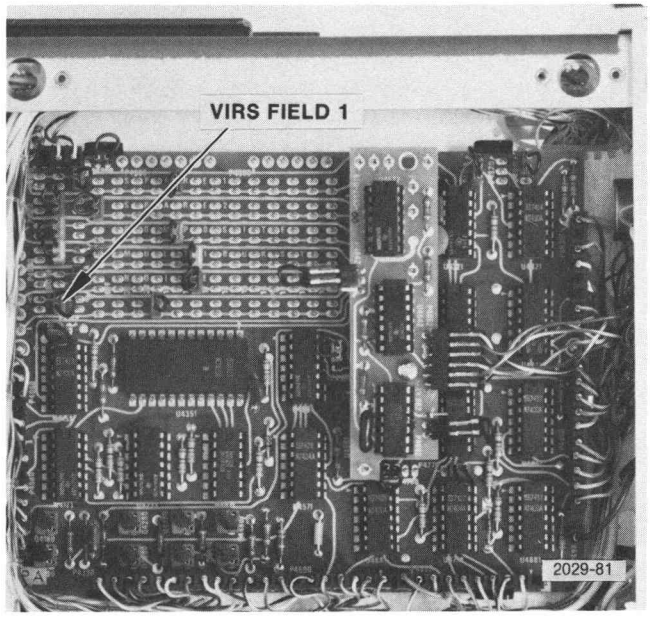
Set the 1480 Line Selector to Line 19. Push the 1480 Dig (Digital) Line Selector button and the All Fields On button. Program the 147A or 149A to generate VIRS only on Field 1 (see Fig. 3-13). This allows the VIRS pedestals on Field 1 to be overlayed with a bright baseline at the blanking level on Field 2.

CHECK—VIRS pedestal amplitudes are as follows:

Signal Level	Amplitude
7.5 IRE	50.0 mV to 57.1 mV (7.5 IRE within 0.5 IRE)
50 IRE	353.6 mV to 360.7 mV (50 IRE within 0.5 IRE)
70 IRE	495.0 mV to 505.0 mV (70 IRE within 0.7 IRE)

ADJUST (147A)—VIRS pedestal amplitudes as follows (see Fig. 3-14 for 147A adjustment locations):

Signal Level	Adjust	Amplitude
7.5 IRE	R8830 (VIRS 7.5% Level)	53.6 mV
50 IRE	R8930 (VIRS 50% Level)	357.1 mV
70 IRE	R8835 (VIRS 70% Level)	500.0 mV



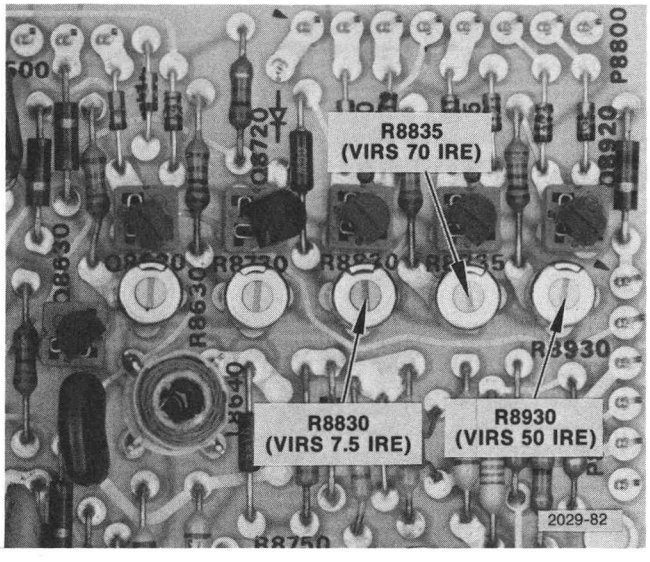


Fig. 3-14. 147A Modulator circuit board showing location of VIRS pedestal adjustments.

ADJUST(149A)—VIRS pedestal amplitudes as follows (see Fig. 3-15 for 149A adjustment locations):

Signal Level	Adjust	Amplitude
7.5 IRE	R467 (VIRS 7.5% Ped)	53.6 mV
50 IRE	R476 (VIRS 50% Ped)	357.1 mV
70 IRE	R475 (VIRS 70% Ped)	500.0 mV

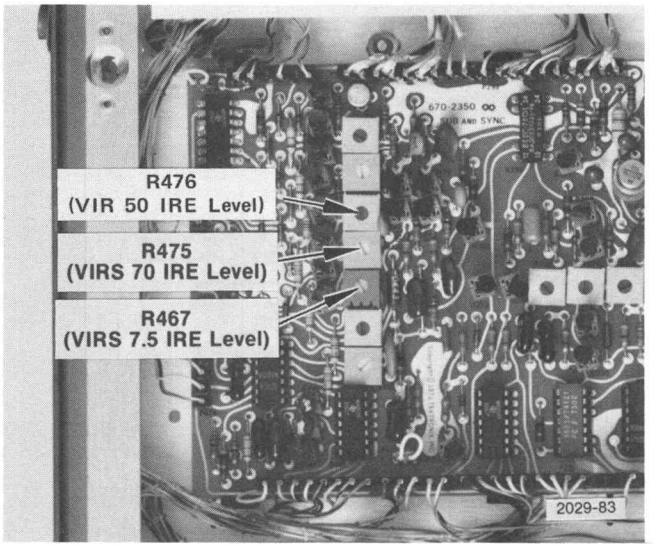


Fig. 3-15. 149A Subcarrier & Sync circuit board showing location of VIRS pedestal adjustments.

Return the 1480 Line Selector and All Fields buttons to Off. Reprogram the 147A or 149A to generate VIRS on Line 19 of Both Fields (see Fig. 3-13).

9. Check/Adjust COLOR BARS Luminance Amplitudes (149A only)

Set the 149A FULL FIELD SIG selector switch to COLOR TEST SIGNAL.

CHECK—Luminance levels are as follows:

Color Bar	Amplitude
Black	52.6 mV to 54.6 mV (53.6 mV within 1 mV)
Blue	107.0 mV to 109.2 mV (108.1 mV within 1%)
Red	200.2 mV to 204.2 mV (202.2 mV within 1%)
Magenta	254.1 mV to 259.3 mV (256.7 mV within 1%)
Green	342.4 mV to 349.4 mV (345.9 mV within 1%)
Cyan	396.2 mV to 404.4 mV (400.4 mV within 1%)
Yellow	489.7 mV to 499.5 mV (494.6 mV within 1%)
White	707.2 mV to 721.4 mV (714.3 mV within 1%)

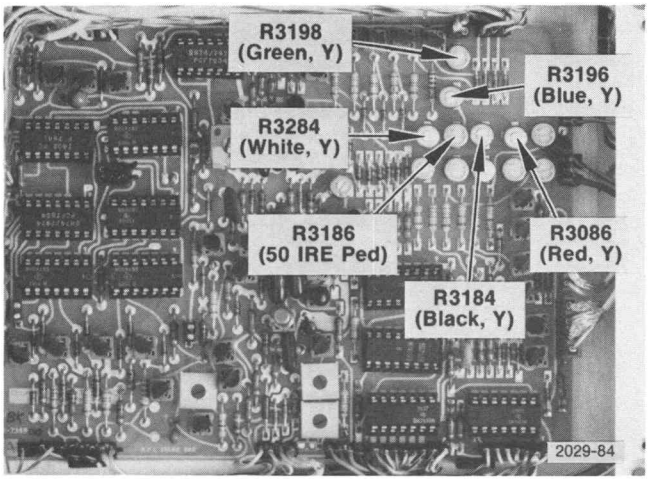


Fig. 3-16. 149A APL and Color Bar circuit board showing COLOR TEST SIGNAL luminance adjustment locations.

ADJUST—Luminance levels to the values given below; check those levels which have no adjustments (see Fig. 3-16 for adjustment locations):

Color Bar	Adjust	Amplitude
Black	R3184 (Black, Y)	53.6 mV
Blue	R3196 (Blue, Y)	108.1 mV
Red	R3086 (Red, Y)	202.2 mV
Magenta	Check	254.1 mV to 259.3 mV
Green	R3198 (Green, Y)	345.9 mV
Cyan	Check	396.4 mV to 404.4 mV
Yellow	Check	489.7 mV to 499.5 mV
White	R3284 (White, Y)	714.3 mV

10. Check/Adjust 50 IRE PEDESTAL (149A only)

Set the COLOR TEST SIGNAL switch to 50 IRE PEDESTAL.

CHECK—Pedestal amplitude is between 353.6 mV and 360.7 mV (50 IRE within 0.5 IRE).

ADJUST—R3186 (50 IRE Pedestal), see Fig. 3-16, for a 50 IRE PEDESTAL amplitude of exactly 357.1 mV (50 IRE).

Return the COLOR TEST SIGNAL switch to COLOR BARS. Push the 1480 Oper button. Reconnect P8490 on the 147A or P8199 on the 149A.

GROUP 4 (149A)—COLOR TEST SIGNAL CHROMINANCE

1. Check/Adjust Color Difference Filter Response

Set the 149A FULL FIELD SIG switch to COLOR TEST SIGNAL. Use a properly compensated 10X probe between the 1480 or the test oscilloscope and test point (TP) under test.

CHECK—Signals at the following test points should have good transient response and similar risetimes, approximately 250 ns: TP8300, TP8309, TP8330, and TP8400 (see Fig. 3-17).

ADJUST—Filters for best transient reponse and similar risetimes.

L8501	+(R-Y)	TP8300
L8401	−(R-Y)	TP8309
L8531	+(B-Y)	TP8330
L8431	−(B-Y)	TP8400

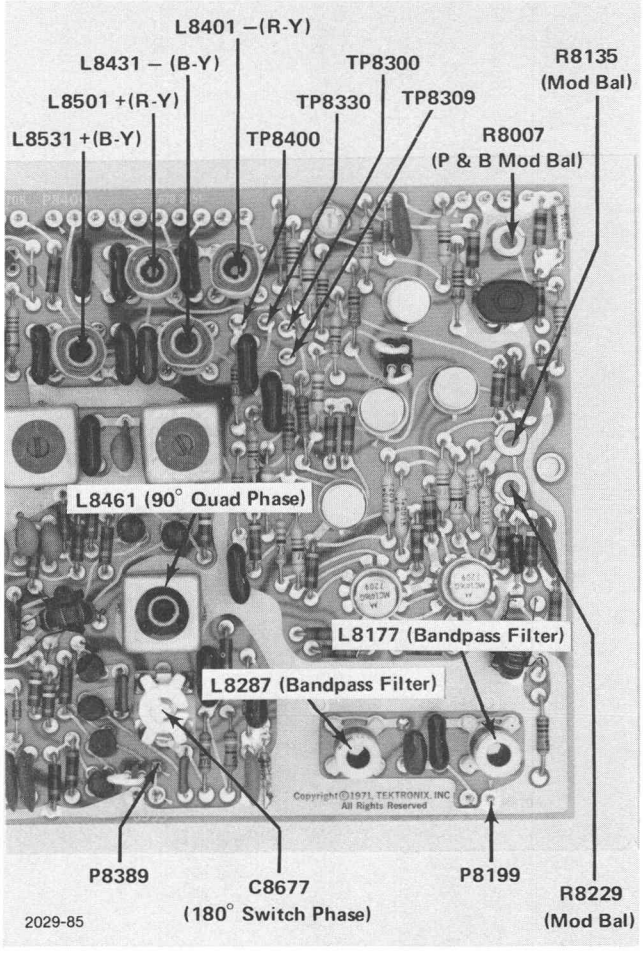


Fig. 3-17. 149A Modulator test point, plug, and adjustment location.

2. Check/Adjust Modulator Balance

CHECK—Each position of the FULL FIELD SIG switch for a modulation amplitude of 2.5 mV or less on the blanking level (0.9 minor divisions or less). If the modulation on the blanking level is acceptable, go to step 3.

Set the FULL FIELD SIG switch to FLAT FIELD.

ADJUST—R8229 and R8135 (Modulator Balance), see Fig. 3-17, for minimum residual subcarrier on the blanking level.

Set the FULL FIELD SIG switch to SIN^2 PULSE & BAR.

ADJUST—R8007 (P & B Modulator Balance), see Fig. 3-17, for minimum modulation on the blanking level.

3. Check/Adjust 180° Switch Phase

Set the FULL FIELD SIG switch to COLOR TEST SIGNAL. Change the connector on P8389 (see Fig. 3-17) to pins 1 and 2 (alternate). Notice that there are alternate color bar vectors on the vectorscope display.

Disconnect plug P3040 (B-Y), see Fig. 3-18. Vary the vectorscope gain to put a color bar vector on the outer graticule ring (compass rose).

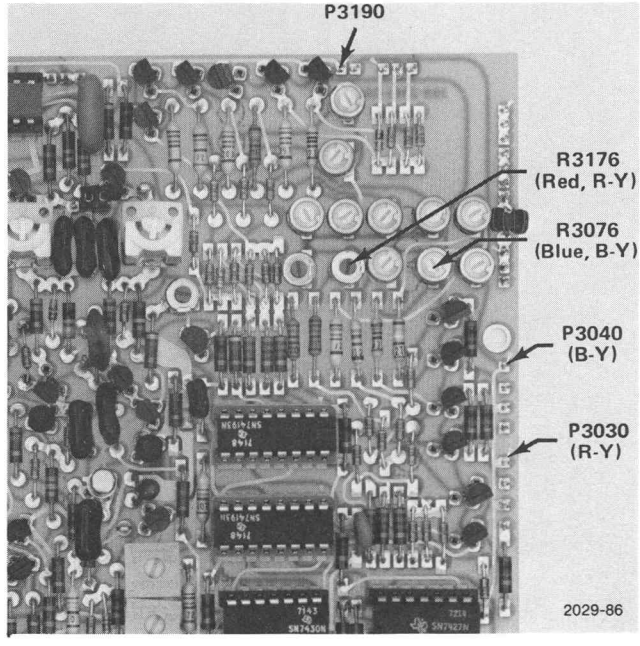


Fig. 3-18. 149A Color Bar pin connector location.

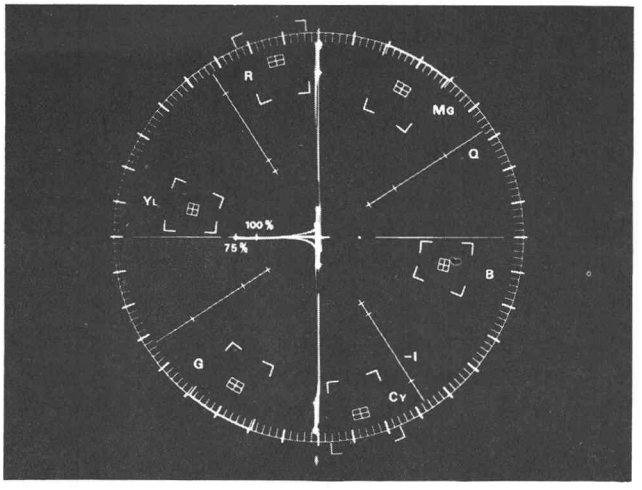
CHECK—Phase error between color bar vectors should be 0.5° or less (see Fig. 3-19).

NOTE

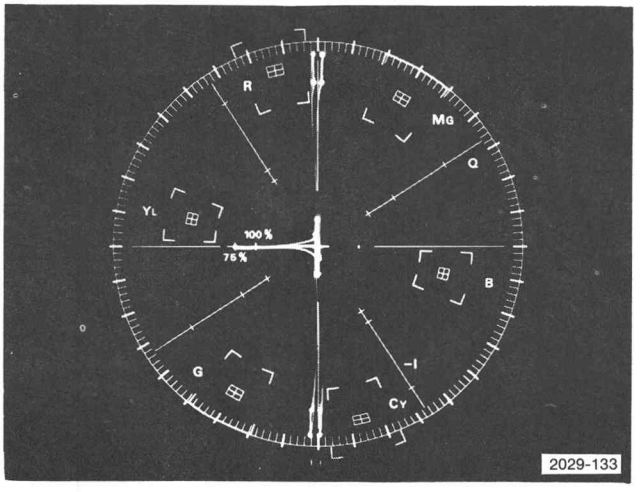
Fig. 3-19B shows misadjustment of the R-Y 180° Phase Switcher. Use the vectorscope calibrated phase dial to measure any error.

ADJUST—C8677 (180° Switcher Phase), see Fig. 3-17, for best overlay of color dots; overlay should be within 0.5°.

Connect plug P3040 (B-Y) and disconnect plug P3030 (R-Y), see Fig. 3-18.



(A) R-Y 180° Phase Switcher properly adjusted.



(B) R-Y 180° Phase Switcher misadjusted.

Fig. 3-19. Typical vectorscope displays used to check and/or adjust the 149A R-Y 180° Phase Switcher.

CHECK—Phase error between color dots should be 0.5° or less.

Connect plug P3030. Connect plug P8389 to pins 2 and 3.

4. Preset Quadrature Phase

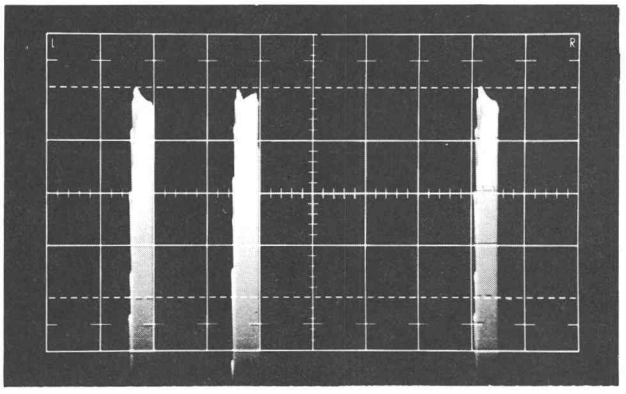
Set the waveform monitor for a 0.2 Volt Full Scale deflection factor and 3.58 MHz Bandpass Response. Position the tops of the cyan (2nd) and red (5th) color packets to the graticule center (see Fig. 3-20).

CHECK—Color bars should overlay within 10 mV (3.5 minor divisions). See Fig. 3-20B for improper overlay.

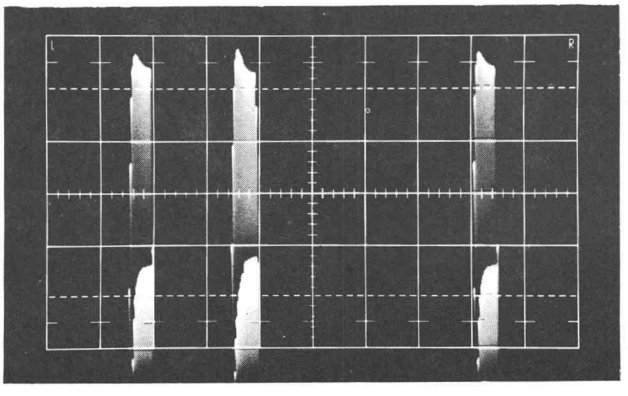
ADJUST—L8461 (90° Quad Phase), see Fig. 3-17, for best color bar overlay; should be within 10 mV (3.5 minor divisions). Recheck Modulator Balance. Return 1480 Reponse to Flat.

5. Check/Adjust Bandpass Filter Response

Disconnect P3190 (see Fig. 3-18) to remove Luminance component.



(A) Correct color bar phasing.



(B) Incorrect color bar phasing.

2029-134

Fig. 3-20. Typical displays showing correct and incorrect adjustment of Color Bar phasing.

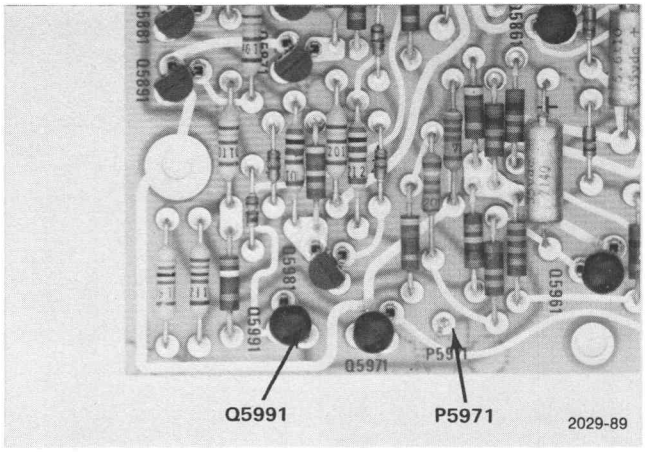
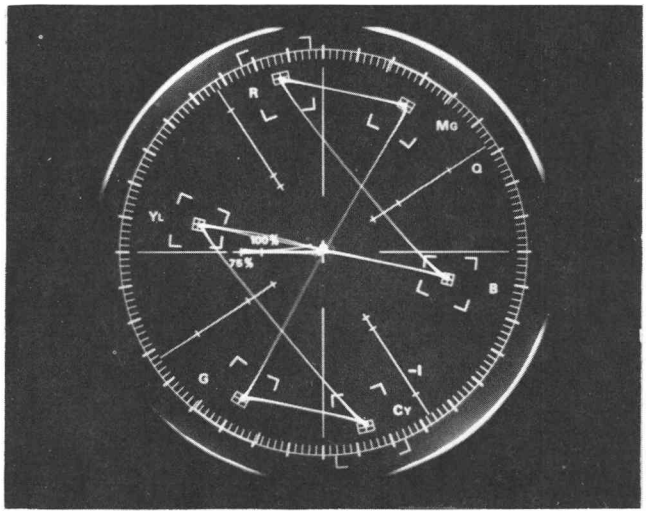
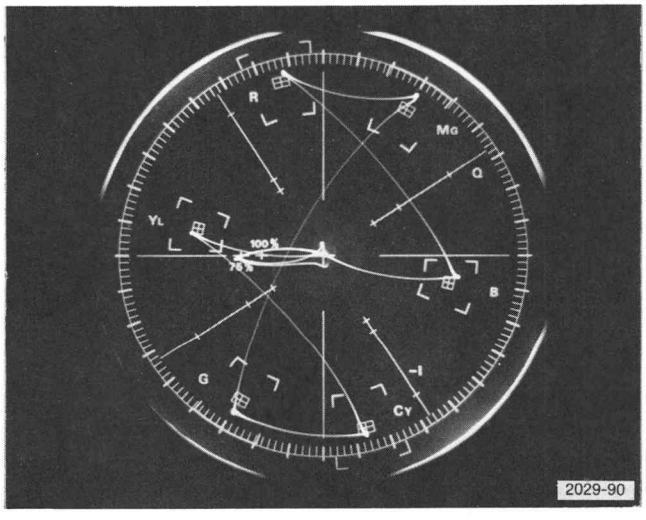


Fig. 3-21. Location of components to remove for free-running chrominance on the 149A.

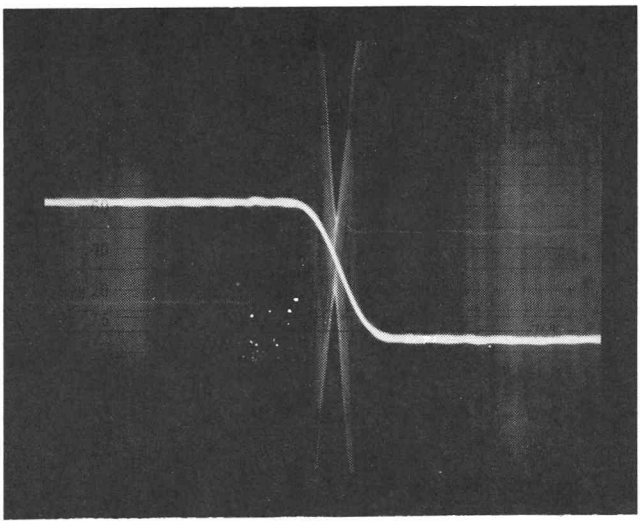


A. Correctly adjusted.

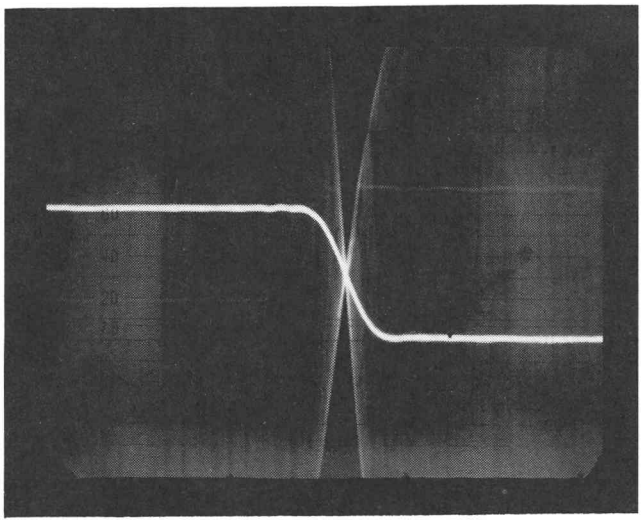


B. Incorrectly adjusted.

Fig. 3-22. 149A Color filter adjustment.



A. Improperly adjusted.



B. Properly adjusted. 2029-91

Fig. 3-23. 149A Bandpass filter response.

Set the SPLIT FIELD/FULL FIELD switch to SPLIT FIELD. Center the green to magenta transition on the monitor. (See Fig. 3-24 for location of green and magenta).

Disconnect P5971 and remove Q5991 to free-run the chrominance signal (see Fig. 3-21).

CHECK—Vectorscope display should be similar to that shown in Fig. 3-22.

CHECK—Monitor display should be similar to that shown in Fig. 3-23.

CHECK—Harmonics should be 40 dB or more below the reference signal.

@

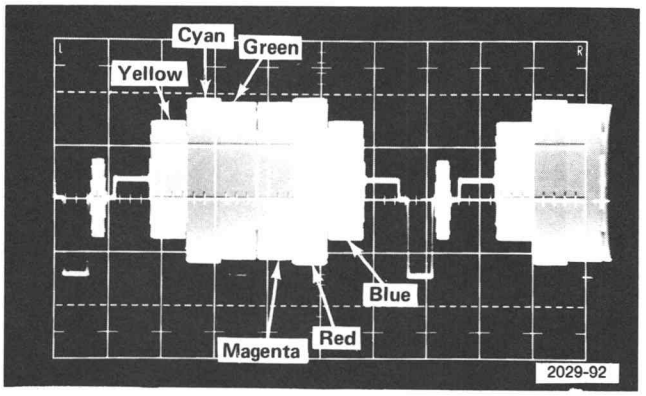


Fig. 3-24. 149A Color Bar signal components.

NOTE

The adjustments in this step affect the harmonic content of the output signal. Only slight adjustment from the original calibration should be attempted without using a spectrum analyzer.

ADJUST—L8287 and L8177 (Bandpass Filter), see Fig. 3-17, for a vector display with straight lines, and for a monitor display having a null at the crossover point.

Connect P5971 and install Q5991.

NOTE

Adjustments performed in step 2 through step 5 of this group interact. Repeat as necessary.

6. Check/Adjust Quadrature Phase

Display the FULL FIELD TEST signal on the test oscilloscope. Connect P8389, see Fig. 3-17, between pins 1 and 2 (alternate). Set the 1480 for a 0.2 Volts Full Scale deflection factor. Position the tops of the cyan (2nd) and red (5th) color packets to the graticule center, see Fig. 3-20.

CHECK—Color bars should overlay within 2 mV at tops and bottoms of the color bars (0.7 minor division).

ADJUST—L8461 (90° Quad Phase) for best color bar overlay; should be within 2 mV at tops and bottoms of the color bars.

Connect P8389 between pins 2 and 3 (normal). Set the FULL FIELD SIG switch to FLAT FIELD.

ADJUST—R8229 and R8135 (Modulator Balance), see Fig. 3-17, for minimum modulation on the blanking level at the white bar.

Set the FULL FIELD SIG switch to COLOR TEST SIGNAL.

ADJUST—R3176 (Red, R-Y) and R3076 (Blue, B-Y), see Fig. 3-19, for minimum modulation on the blanking level at the white bar.

7. Check Spurious Subcarrier Amplitude

Observe the area of the color bar signal between blue and the front porch (set up level, Black).

CHECK—Residual subcarrier should be 2.5 mV or less (0.7 minor division or less).

Observe the area of the color bar signal between the back porch and yellow (white reference).

CHECK—Residual subcarrier should be 2.5 mV or less.

Observe the starting point of the white reference portion of the signal.

CHECK—Aberration at the start of the white reference should be 32 mV or less.

8. Check Chrominance Amplitude

Push the 1480 Oper and Cal buttons. Use the test fixture to measure the chrominance amplitudes. Leave P3190 (Y) disconnected. Fig. 3-25 shows the waveform for measuring the red color bar with the 1480 test fixture.

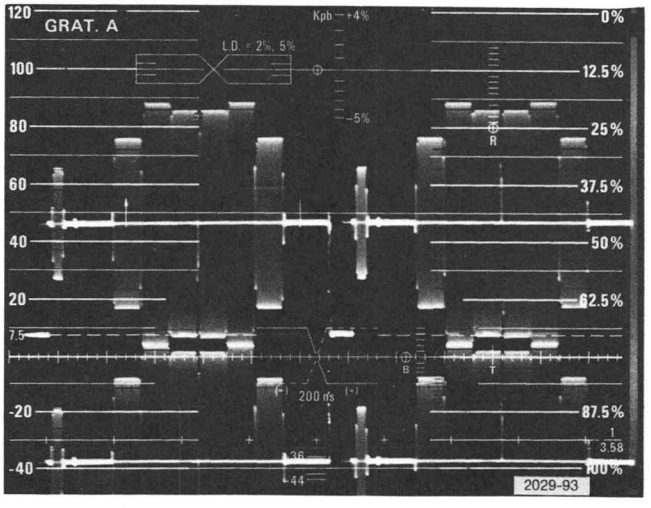


Fig. 3-25. Waveform showing 149A red color bar peaks just overlaying.

CHECK—Total amplitudes within 3% as follows:

Color	Absolute Amplitude	Tolerance
Blue, Yellow	445.1 mV	431.7 - 458.5 mV
Red, Cyan	625.9 mV	607.1 - 644.6 mV
Green, Magenta	588.3 mV	570.7 - 605.9 mV
White, Black	0 mV	2.5 mV or less

Note the amplitudes measured.

CHECK—Relative amplitudes are within 1% of each other. Measure the Red color bar amplitude, and apply the result to the formula:

$$\frac{\text{Measured Value}}{\text{Standard Value}} \times 100 = \text{Red relative amplitude in \%}$$

where the standard value is the absolute value given in the table above.

EXAMPLE: Assume that the red color bar measured 632.2 mV. Applying the formula:

$$\frac{632.2\text{ mV}}{625.9\text{ mV}} \times 100 = 101\%$$

Note that the red color bar is 1% above the standard value.

Repeat this step for each remaining color listed in the table. All other amplitudes should be within 1% of the red relative amplitude.

EXAMPLE: Assume that the blue color bar measured 454.0 mV. Applying the formula:

$$\frac{454.0\text{ mV}}{445.1\text{ mV}} \times 100 = 102\%$$

Note that the blue color bar is within 1% of the red relative amplitude.

If the above requirements are met, go to step 12. If the above requirements are not met, steps 9, 10 and 11 must be performed.

9. Check/Adjust R-Y Chrominance Amplitudes

Disconnect P3040 (B-Y). Preset R3274 (Blue) to midrange. Leave P3190 (Y) disconnected. (See Fig. 3-26 for location of adjustments and connectors).

CHECK—R-Y chrominance amplitudes are within 1% or 1 mV, whichever is greater, as follows:

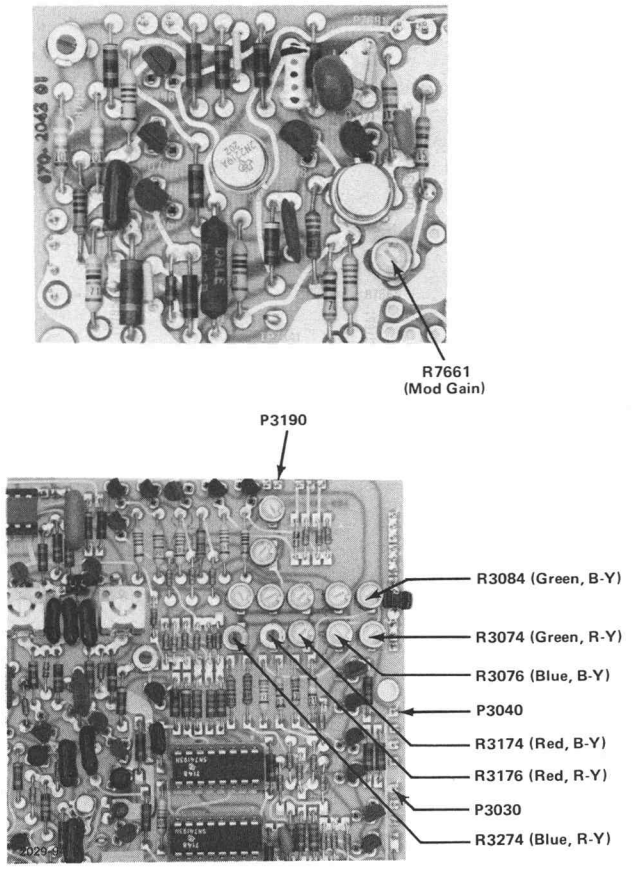


Fig. 3-26. 149A Color Bar pin connector and adjustment locations.

Color	P-P Amplitude	Tolerance
Red, Cyan	608.5 mV	602.4 - 614.6 mV
Blue, Yellow	95.6 mV	94.6 - 96.6 mV
Green, Magenta	512.9 mV	507.8 - 518.0 mV

ADJUST—R-Y chrominance amplitudes as follows:

Adjust	Color	Amplitude
R7661 (Mod Gain)	Blue	95.6 mV
R3074 (Green, R-Y)	Green	512.9 mV
R3176 (Red, R-Y)	adjust for modulation null on white bar	
check	Red	602.4 - 614.6 mV
check	Cyan	602.4 - 614.6 mV
check	Magenta	507.8 - 518.0 mV
check	Yellow	94.6 - 96.6 mV

Connect plug P3040.

10. Check/Adjust B-Y chrominance amplitudes

Disconnect P3030 (R-Y). (See Fig. 3-26 for location of adjustments and connectors.)

CHECK—B-Y chrominance amplitudes as follows:

Color	P-P Amplitude	Tolerance
Red, Cyan	146.5 mV	145.0 - 148.0 mV
Blue, Yellow	434.7 mV	430.6 - 439.0 mV
Green, Magenta	288.2 mV	285.3 - 291.1 mV

ADJUST—B-Y chrominance amplitudes as follows:

Adjust	Color	P-P Amplitude
R3174 (Red, R-Y	Red	146.5 mV
R3084 (Green, R-Y)	Green	288.2 mV
R3076 (Blue, R-Y)	adjust for modulation null on white bar	
check	Blue	430.4 - 439.0 mV
check	Yellow	430.4 - 439.0 mV
check	Magenta	285.3 - 291.1 mV
check	Cyan	145.0 - 148.0 mV

Connect P3030.

11. Check Total Chrominance Amplitudes

Repeat step 8.

12. Check/Adjust Modulated Pedestal Chrominance

Set the COLOR BARS/MODULATED PEDESTAL/50 IRE PEDESTAL switch to MODULATED PEDESTAL. Leave P3190 (Y) disconnected.

CHECK—Modulated pedestal chrominance within 0.5 IRE as follows:

Pedestal	Amplitude	Tolerance
20 IRE	142.9 mV	139.3 - 146.5 mV
40 IRE	285.7 mV	282.1 - 289.3 mV
80 IRE	571.4 mV	567.8 - 575.0 mV

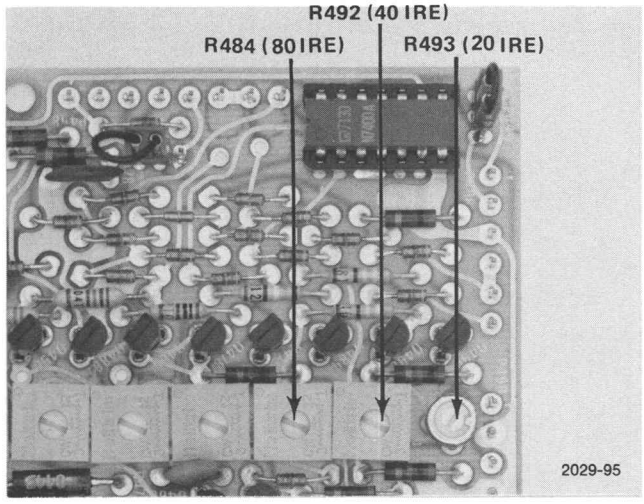


Fig. 3-27. 149A Modulated Pedestal chrominance adjustment locations.

ADJUST—Modulated pedestal chrominance as follows. See Fig. 3-27 for adjustment location.

Adjust	Amplitude
R493 (20 IRE)	142.9 mV
R492 (40 IRE)	285.7 mV
R485 (80 IRE)	571.4 mV

Connect P3190.

13. Check SPLIT FIELD Sequence

Display the rear-panel FULL FIELD TEST signal on the monitor.

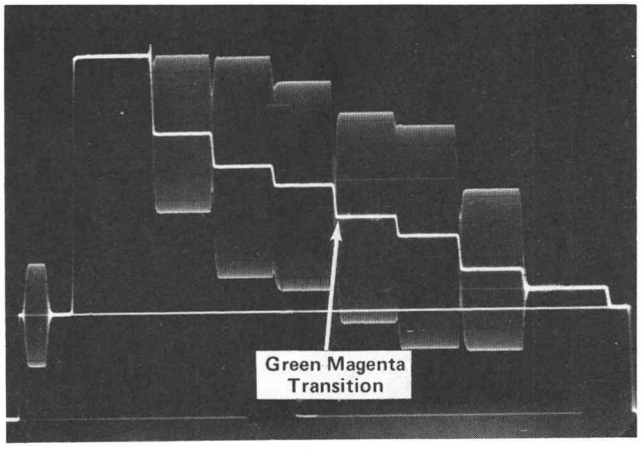
Check—The SPLIT FIELD signal should start with luminance, switch to a half field of chrominance, then switch back to luminance.

14. Check MODULATED PEDESTAL Phase

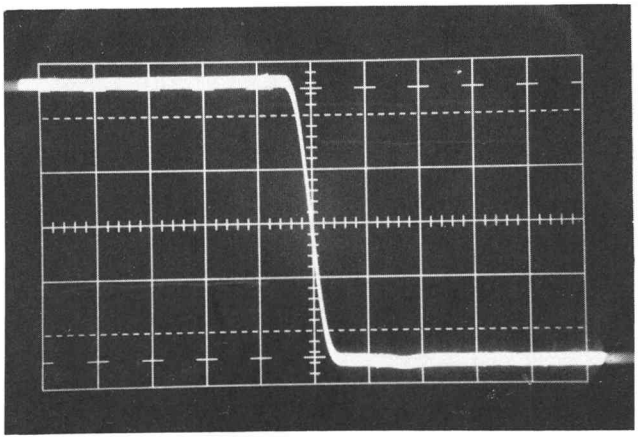
Set the COLOR TEST SIGNAL switch to MODULATED PEDESTAL.

CHECK—Chroma-to-burst phase as displayed on the vectorscope should be 90° within 1°.

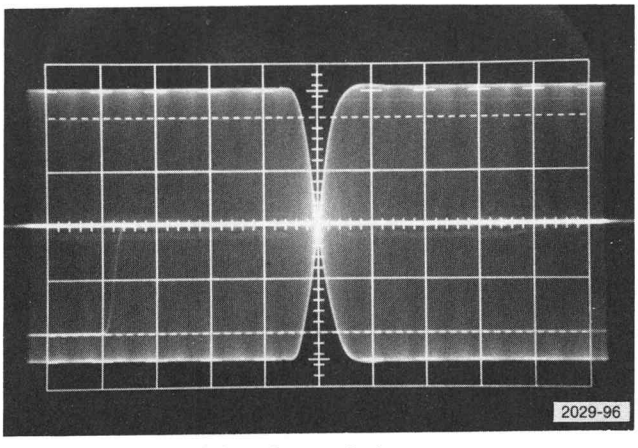
CHECK—Phase error between the different chrominance levels should be 0.2° or less.



A. Color bar component location.



B. Properly centered luminance display.



C. Properly centered chrominance display.

Fig. 3-28. Typical displays to check or adjust luminance to chrominance delay.

15. Check/Adjust Luminance-to-Chrominance Delay

Set the COLOR TEST SIGNAL switch to COLOR BARS. Display the front-panel FULL FIELD SIG OUT signal on the test oscilloscope. Set the waveform monitor to display the green, magenta cross-over point (see Fig. 3-28A).

Disconnect plug P5971 and remove Q5991 (see Fig. 3-21).

Set the waveform monitor vertical gain and positioning controls so that the luminance component is 4 to 5 divisions high and exactly centered vertically (see Fig. 3-28B).

CHECK—Luminance transition crosses through the chrominance null at the 50% amplitude point (crt center) within 20 ns (see Fig. 3-28C for chrominance null).

ADJUST—R3369 (Delay), see Fig. 3-29, for matching luminance to chrominance, within 20 ns.

16. Check Chrominance Envelope Risetime

Disconnect plug P3190 (Y), see Fig. 3-26.

CHECK—Yellow (1st) chrominance envelope risetime should be between 323 and 431 ns.

Connect plug P5971 and install Q5991.

17. Check Modulated Pedestal Duration

Set the COLOR TEST SIGNAL switch to MODULATED PEDESTAL.

CHECK—Modulated pedestal duration as given below:

20 IRE modulation	13 μs wide
40 IRE modulation	13 μs wide
80 IRE modulation	13 μs wide

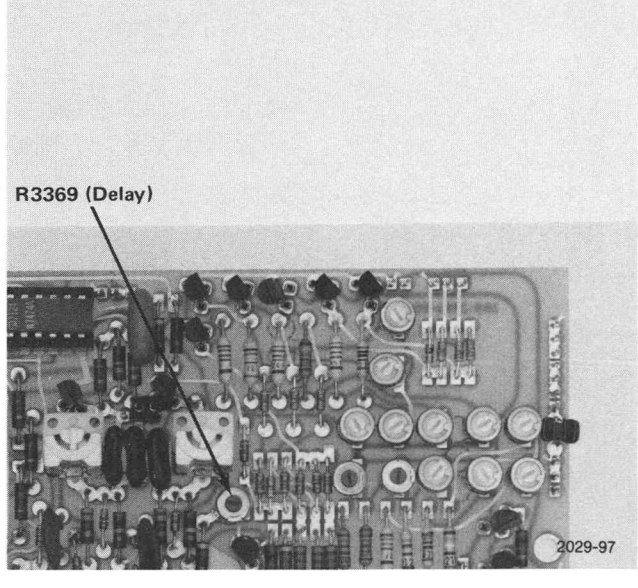


Fig. 3-29. Location of Color Bar delay adjustment.

@

GROUP 5 (147A)—MODULATED PULSE

1. Check/Adjust Modulator Balance (FLAT FIELD

Connect plug P8490 (see Fig. 3-5).

Set the 147A FULL FIELD SIG selector switch to FLAT FIELD, and the 1480 Waveform Monitor controls to 3.58 MHz Bandpass and 0.2 Volts Full Scale.

CHECK—Residual subcarrier is 2.5 mV or less (0.9 minor division or less).

ADJUST—R8960 and C8689 (Modulator Balance), see Fig. 3-30, for minimum residual subcarrier (0.9 minor division or less).

2. Check/Adjust Modulator Balance (PULSE & BAR)

Set the 147A FULL FIELD SIG selector switch to SIN^2 PULSE & BAR.

CHECK—Residual subcarrier is 2.5 mV or less (0.9 minor division or less).

ADJUST—R8750 (Modulation Balance), see Fig. 3-30, for minimum residual subcarrier (0.9 minor division or less).

3. Check/Adjust 12.5T/20T Pulse Luminance

Set the waveform monitor Response switch to Flat, and 1.0 Volts Full Scale.

Disconnect plug P8490 (see Fig. 3-5).

CHECK—Trailing corner of the modulated 12.5T Pulse is flat.

CHECK—12.5T Pulse is symmetrical.

Set the 1480 Mag switch to .25 μs/Div.

CHECK—12.5T Pulse Half Amplitude Duration (HAD) is 1.57 μs within 75 ns (1.495 to 1.645 μs).

Reset the 1480 Mag switch to Off.

ADJUST—R6458 (Mod Pulse Level), see Fig. 3-30, for the best trailing corner of the 12.5T pulse.

ADJUST—R6362 (Mod Pulse Symmetry), see Fig. 3-30, for a symmetrical pulse. Measure at the HAD points.

Set the 1480 Mag switch to .25 μs/Div.

ADJUST—R6354 (Mod Pulse Width), see Fig. 3-30, for a 12.5T pulse HAD of 1.57 μs.

Reset the 1480 Mag switch to Off.

Change the connector on P6050 to pins 1 and 2 (20T Pulse), see Fig. 3-30.

CHECK—Trailing corner of 20T pulse is flat.

CHECK—20T pulse is symmetrical.

CHECK—20T pulse HAD is 2.5 μs within 0.1 μs.

If necessary, readjust R6458, R6362, and R6354 for the best compromise between the 12.5T pulse and the 20T pulse.

Replace the connector on P6050 to pins 2 & 3 (12.5T).

CHECK—12.5T pulse amplitude is 357.1 mV within 1.8 mV (50 IRE within 0.25 IRE).

ADJUST—R7357 (Luminance Gain), see Fig. 3-3, for a 12.5T pulse luminance amplitude of 357.1 mV (50 IRE).

CHECK—Horizontal and vertical blanking levels match.

ADJUST—R7453 (P & B Sync Level), see Fig. 3-30, to match the horizontal and vertical blanking levels.

Reconnect P8490.

4. Check/Adjust Modulated Pulse Chrominance

CHECK—Modulation at the bottom of the pulse is symmetrical.

CHECK—Harmonics are −40 dB or lower in amplitude at all positions of the FULL FIELD SIG Selector, except MULTIBURST. (Use spectrum analyzer.)

CHECK—Modulated Pulse amplitude is 714.3 mV within 36 mV (100 IRE within 0.5 IRE).

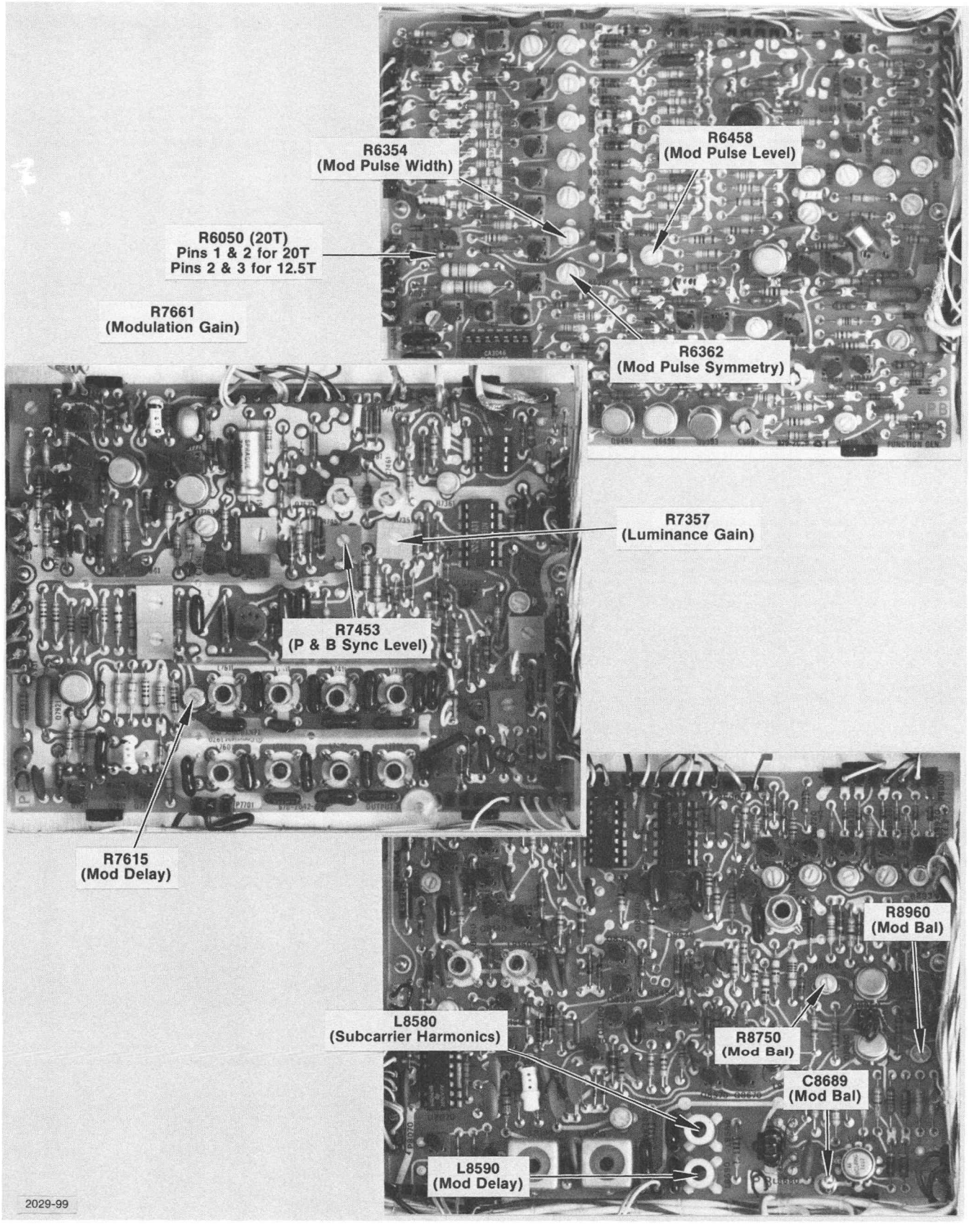


Fig. 3-30. 147A Modulated Pulse adjustments and connectors.

The following three adjustments interact. Repeat as necessary.

ADJUST—R7615 and L8590 (Mod Delay), see Fig. 3-30, for symmetrical modulation on the bottom of the pulse.

ADJUST—L8580 (Subcarrier Harmonics), see Fig. 3-30, for minimum amplitude of harmonics measured with spectrum analyzer (≤−40 dB).

ADJUST—R7661 (Modulation Gain), see Fig. 3-30, for a Modulated Pulse amplitude of 714.3 mV (100 IRE).

NOTE

A slight adjustment of R7357 may be necessary to obtain a flat bottom on the pulse baseline.

5. Check/Adjust Modulated Pulse Phasing

Observe the vectorscope display of the Modulated Pulse signal. Set R8060 (Mod Pulse Phase), see Fig. 3-30, fully cw.

CHECK—Vectorscope display appears as a fan shaped circle with an opening of approximately 20° to 60°, as shown in Fig. 3-31.

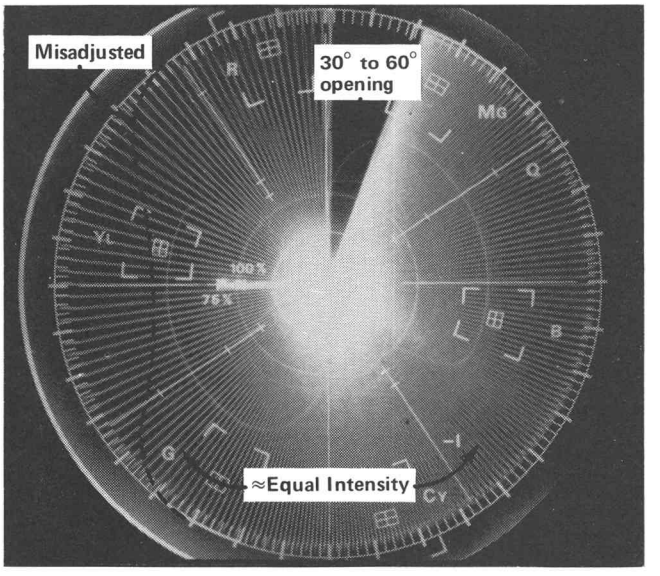


Fig. 3-31. Typical vectorscope display of the 147A Modulated Pulse when the variable modulation filters are adjusted.

ADJUST—L8050 and L8150 (Variable Modulation Filters) to obtain the symmetrical display as shown in Fig. 3-31.

GROUP 5 (149A)—MODULATED PULSE

1. Check/Adjust 12.5T/20T Pulse Luminance

Set the 149A to SIN^2 PULSE & BAR. Disconnect P8199 (see Fig. 3-32). Set the 1480 Waveform Monitor to 1.0 Volts Full Scale.

CHECK—Trailing corner of the modulated 12.5T pulse is flat.

CHECK—12.5T pulse is symmetrical.

Set the 1480 Mag switch to .25 μs/Div.

CHECK—12.5T pulse Half Amplitude Duration (HAD) is 1.57 μs within 75 ns (1.495 to 1.645 μs).

Reset the 1480 Mag switch to Off.

ADJUST—R6458 (Mod Pulse Level), see Fig. 3-32, for the best trailing corner of the 12.5T pulse.

ADJUST—R6362 (Mod Pulse Symmetry), see Fig. 3-32, for a symmetrical pulse. Measure at the HAD points.

Set the 1480 Mag switch to .25 μs/Div.

ADJUST—R6354 (Mod Pulse Width), see Fig. 3-32, for a 12.5T pulse HAD of 1.57 μs.

Reset the 1480 Mag switch to Off.

Change the connector on P6050 to pins 1 and 2 (20T Pulse), see Fig. 3-32.

CHECK—Trailing corner of 20T pulse is flat.

CHECK—20T pulse is symmetrical.

CHECK—20T pulse HAD is 2.5 μs within 0.1 μs.

If necessary, readjust R6458, R6362, and R6354 for the best compromise between the 12.5T and 20T pulses.

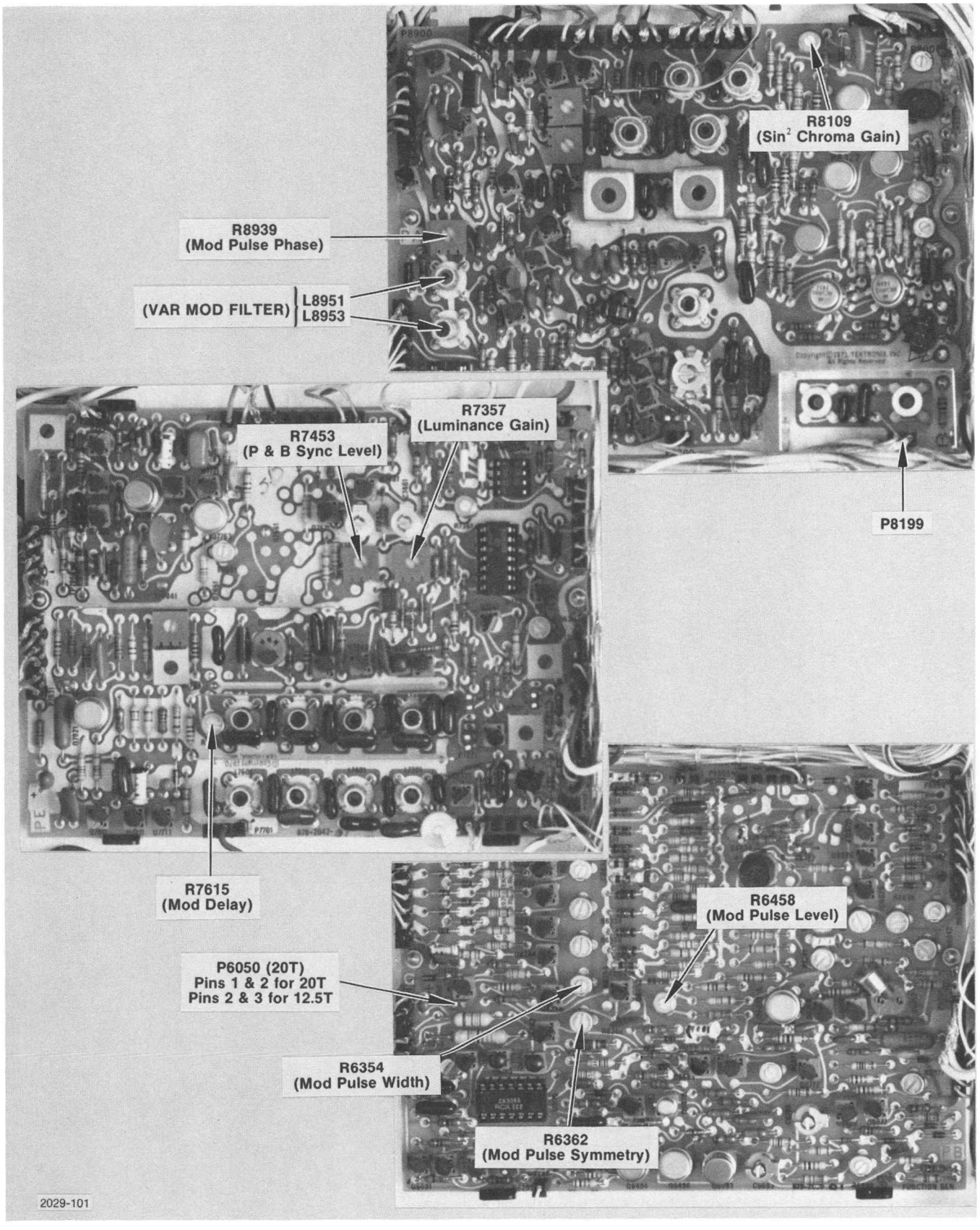


Fig. 3-32. 149A Modulated Pulse adjustments and connectors.

Replace the connector on P6050 to pins 2 and 3 (12.5T).

CHECK—12.5T pulse amplitude is 357.1 mV within 1.8 mV (50 IRE within 0.25 IRE).

ADJUST—R7357 (Luminance Gain), see Fig. 3-32, for a 12.5T Pulse luminance amplitude of 357.1 mV (50 IRE).

CHECK—Horizontal and vertical blanking levels match.

ADJUST—R7453 (P & B Sync Level), see Fig. 3-32, to match the horizontal and vertical blanking levels.

Reconnect plug P8199.

2. Check/Adjust Modulated Pulse Chrominance

CHECK—Modulation on the bottom of the pulse is symmetrical.

CHECK—Modulated Pulse amplitude is 714.3 mV within 3.6 mV (100 IRE within 0.5 IRE).

ADJUST—R7615 (Mod Delay), see Fig. 3-32, for a symmetrical bottom on the Modulated Pulse.

ADJUST—R8109 (Sin^2 Chroma Gain), see Fig. 3-32, for a Modulated Pulse amplitude of 714.3 mV (100 IRE).

NOTE

A slight readjustment of R7357 (Luminance Gain) may be necessary to obtain a flat bottom on the pulse baseline.

3. Check/Adjust Pulse Phasing

Observe the vectorscope display of the Modulated Pulse signal. Preset R8939 (Mod Pulse Phase), see Fig. 3-32, fully clockwise.

CHECK—Vectorscope display appears as a fan-shaped circle with an opening of approximately 0° to 60°.

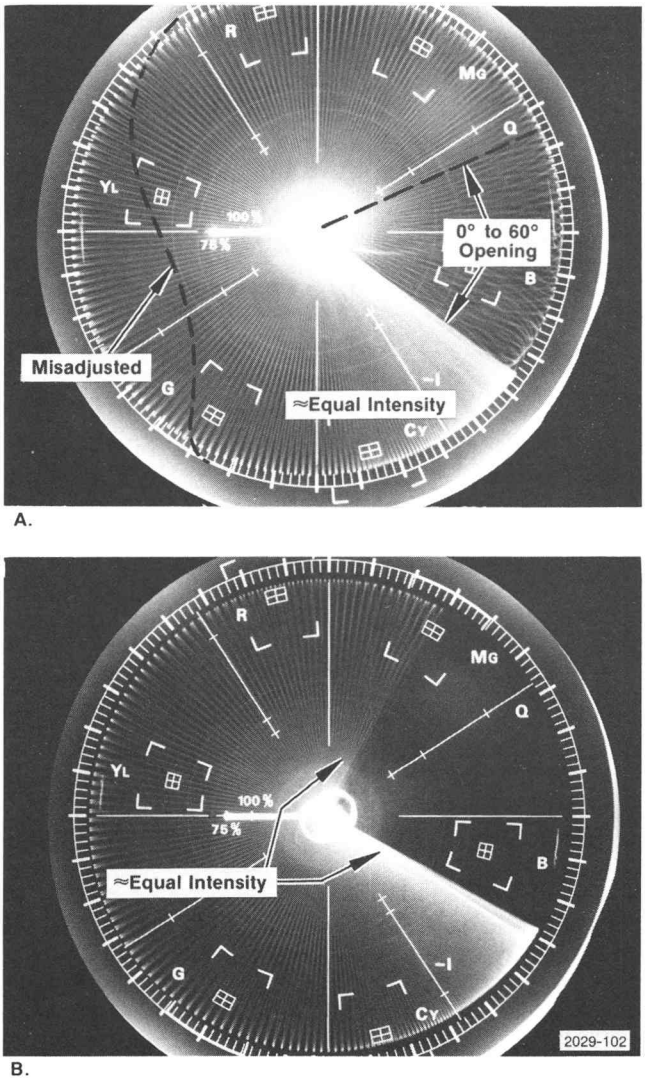


Fig. 3-33. Typical vectorscope displays of modulated pulse when the variable modulation filter is adjusted.

ADJUST—L8951 and L8953 (Var Mod Filter), see Fig. 3-32, for the best symmetry on the vector display, as shown in Fig. 3-33A.

Set R8939 for the vector display opening to stop at Magenta, about 61°, as shown in Fig. 3-33B.

GROUP 6—CHROMINANCE

1. Check/Adjust LINEARITY Subcarrier Amplitude

Set the FULL FIELD SIG Selector switch to LINEARITY, and the SUBCARRIER switch to ON.

CHECK—Peak-to-peak subcarrier amplitude is between 282.1 mV and 289.3 mV (40 IRE within 0.5 IRE).

ADJUST—R3410 (40 IRE Mod Ampl), see Fig. 3-34, for exactly 285.7 mV (40 IRE).

Change the connector on P3400 to pins 1 and 2 (20 IRE).

CHECK—Peak-to-peak subcarrier amplitude is between 139.3 mV and 146.5 mV (20 IRE within 0.5 IRE).

ADJUST—R3420 (20 IRE Mod Ampl), see Fig. 3-34, for exactly 142.9 mV (20 IRE).

Return the connector on P3400 to pins 2 and 3 (40 IRE).

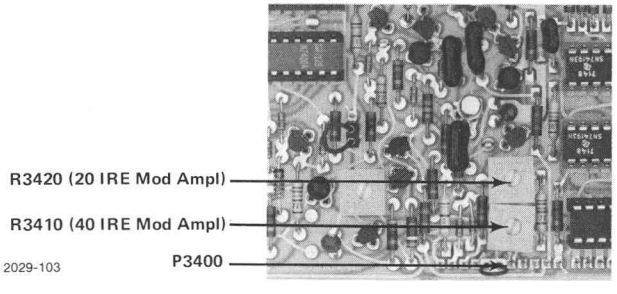


Fig. 3-34. Linearity chrominance adjustment and connector locations.

2. Check/Adjust BURST Amplitude

CHECK—Peak-to-peak Burst amplitude is between 282.1 mV and 289.3 mV (40 IRE within 0.5 IRE).

ADJUST—R8705 (149A) or R8620 (147A), (Burst Ampl), see Fig. 3-35, for a peak-to-peak Burst amplitude of exactly 285.7 mV (40 IRE).

3. Check/Adjust VIRS Modulation Amplitude

Set the 1480 Line Selector to Line 19. Push the 1480 Dig (Digital) Line Selector button and the All Fields On button.

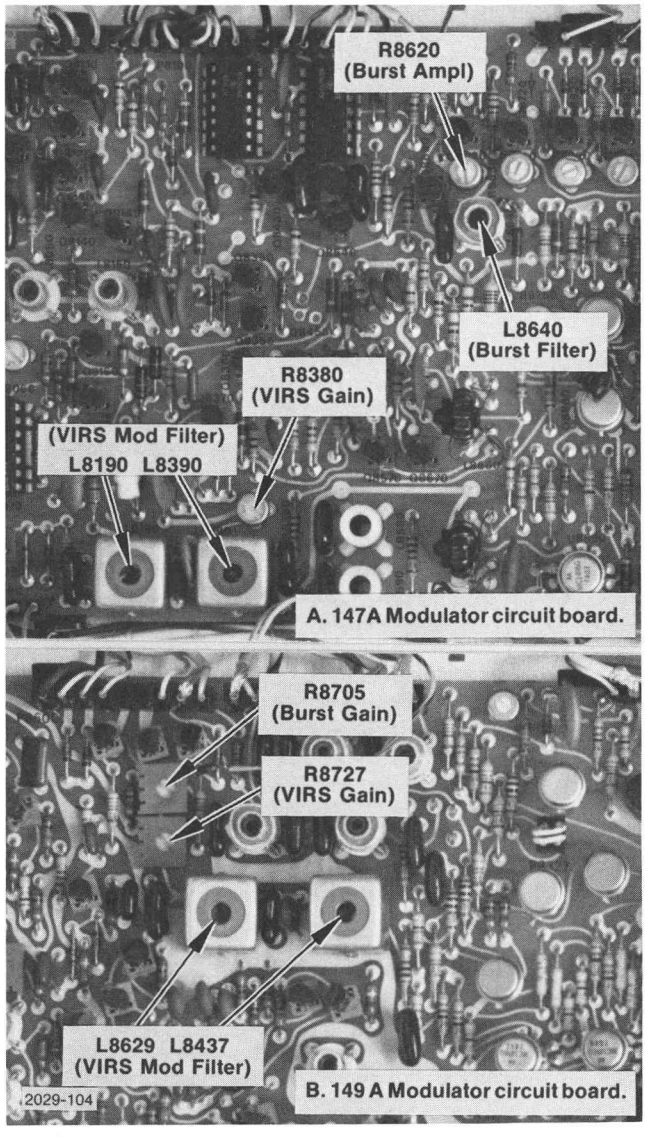


Fig. 3-35. Burst and VIRS modulation adjustment locations.

CHECK—VIRS modulation amplitude is between 282.8 mV and 288.6 mV (40 IRE within 0.4 IRE).

ADJUST—R8380 (147A) or R8727 (149A), (VIRS Gain), see Fig. 3-35, for VIRS chrominance amplitude of exactly 285.7 mV (40 IRE).

4. Check/Adjust VIRS and Burst Envelope Risetimes

Push the 1480 Oper button. Shut off the burst on the incoming video signal source (140). Disconnect plug P5971 and remove Q5991, see Fig. 3-36, so that the chrominance smoothly free runs.

CHECK—VIRS envelope risetime (10% to 90% peak) should be 0.85 μs to 1.15 μs (1 μs within 15%).

ADJUST—L8190 and L8390 for the 147A, or L8629 and L8437 for the 149A (VIRS Mod Filter), see Fig. 3-35, for the best front corner and a risetime of 0.85 μs to 1.15 μs (1 μs within 15%).

Push the 1480 Line Selector and All Fields Off buttons.

CHECK—Burst envelope risetime should be between 323 ns and 431 ns (375 ns within 15%).

ADJUST (147A only)—L8640 (Burst Filter), see Fig. 3-35, for the best front corner on the burst, and for risetime between 323 ns and 431 ns (375 ns within 15%).

Turn the incoming video source (140) Burst on. Replace P5971 and Q5991.

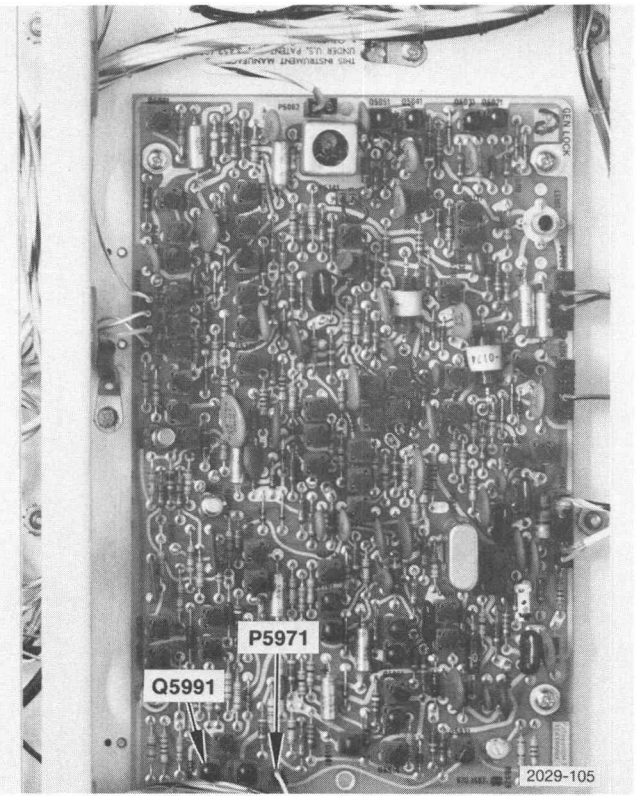


Fig. 3-36. Gen Lock circuit board showing locations of components to free-run chrominance.

GROUP 7—MULTIBURST

NOTE
See Fig. 3-37 for adjustment locations.

1. Check/Adjust Harmonics

Connect the 1401A Spectrum Analyzer as instructed in the Test Equipment portion of this section.

Set the FULL FIELD SIG selector switch to MULTIBURST. Remove P8490 from the 147A, or P8199 from the 149A.

CHECK—All Multiburst harmonics are lower in amplitude than −40 dB from the reference.

ADJUST—C6693, C6788, R6898, and R6977 (MB Harmonics) for minimum harmonics (−40 dB attenuation or more).

Replace P8490 on the 147A, or P8199 on the 149A.

2. Check/Adjust Multiburst Frequencies

Check and adjust the Multiburst frequency accuracy as follows:

Burst Packet	Waveform Monitor	CHECK	ADJUST
500 kHz	.5 μs/Div	2 cycles in 8 div ±0.24 div	R6304
1.25 MHz (149A)	.2 μs/Div	2 cycles in 8 div ±0.24 div	R6202
1.5 MHz (147A)	.2 μs/Div	3 cycles in 10 div ±0.3 div	R6202
2.0 MHz	.2 μs/Div	4 cyles in 10 div ±0.3 div	R6314
3.0 MHz	.1 μs/Div	3 cycles in 10 div ±0.3 div	R6324
3.58 MHz	.1 μs/Div	3 cycles in 8.13 to 8.63 div	R6334
4.1 MHz (149A)	.1 μs/Div	3 cycles in 7.17 to 7.46 div	R6344
4.2 MHz (147A)	.1 μs/Div	3 cycles in 7.00 to 7.23 div	R6344

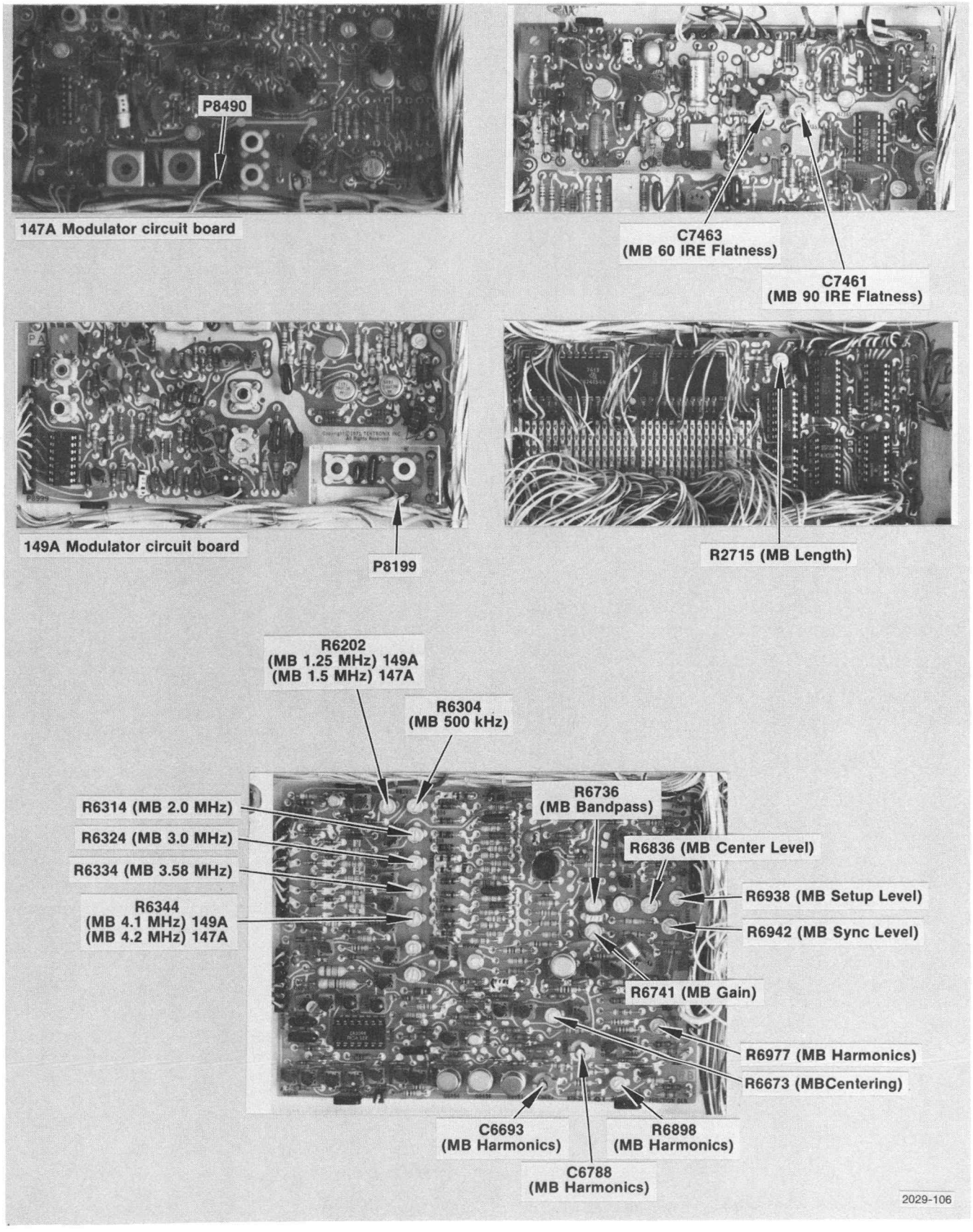


Fig. 3-37. Multiburst adjustment locations.

Recheck harmonics. The harmonics and frequency adjustments are interactive; if either is adjusted, the other must be checked.

3. Check/Adjust for Whole Cycles

Reset the waveform monitor to 5 μs/Div and the Volts Full Scale Var in detent.

CHECK—The 500 kHz packet contains at least three complete cycles for the 147A, or at least four complete cycles for the 149A; and the remaining packets consist of complete sinewave starting and stopping at the center reference level.

ADJUST—R2715 (MB Length) for three complete cycles of 500 kHz for the 147A, or four complete cycles of 500 kHz for the 149A, and complete cycles of the remaining packets.

4. Check/Adjust Multiburst Flatness

Set the MULTIBURST AMPLITUDE switch to REDUCED (147A) of 60 IRE (149A). Set the 1480 to 0.2 Volt Full Scale (calibrated), 2 Field Display, and X50 Mag.

CHECK—Tops and bottoms of Multiburst packets are flat within 1.25 minor divisions (0.5 IRE).

ADJUST—R6736 (MB Bandpass) for symmetrical tops and bottoms, and C7463 (60 IRE MB Flatness) for flat tops and bottoms.

Set the MULTIBURST AMPLITUDE switch to NORMAL (147A) or FULL (149A).

CHECK—Tops and bottoms of packets are flat within 1.25 minor divisions (0.5 IRE).

ADJUST—C7461 (90 IRE MB Flatness) for flat tops and bottoms.

Recheck the 60 IRE flatness, then leave the MULTIBURST AMPLITUDE switch set to NORMAL (147A) or FULL (149A).

If the packets are not flat, re-do steps 1 through 3 of this group. Adjust for the best compromise between harmonics and flatness.

5. Check/Adjust Multiburst Average Level

Push the vectorsope Y button.

CHECK—The last packet level matches the reference level (see Fig. 3-38).

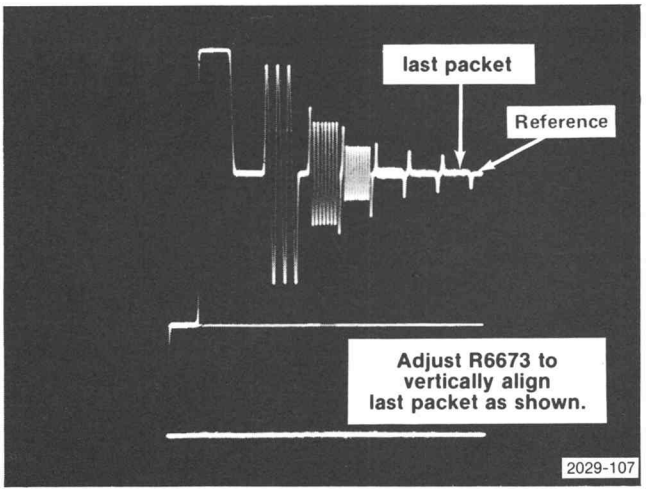


Fig. 3-38. Typical vectorscope (Y) display of Multiburst luminance.

ADJUST—R6673 (MB Centering) to match the level of the last packet to the reference level.

6. Check/Adjust Multiburst Sync Level

CHECK—Horizontal and vertical sync levels are the same.

ADJUST—R6942 (MB Sync Level) to match the horizontal and vertical sync levels.

7. Check/Adjust Multiburst Amplitudes

Recheck accuracy of the MB center level (R6836) for 55 IRE within 1 IRE.

CHECK—Peak-to-peak amplitude of the 500 kHz packet is between 635.7 mV and 650.0 mV (90 IRE within 1 IRE).

ADJUST—R6741 (MB Gain) for exactly 642.9 mV (90 IRE within 1 IRE).

Set the MULTIBURST AMPLITUDE switch to REDUCED (147A) or 60 IRE (149A).

CHECK—The peak-to-peak amplitude of the 500 kHz packet is between 421.4 mV and 435.7 mV (60 IRE within 1 IRE).

8. Recheck Mod Pulse

Recheck Step 1 of Group 5 for proper width, symmetry, and matching of blanking levels. These adjustments interact with the Multiburst adjustments (if one is adjusted, the others must be checked).

GROUP 8—PULSE AMPLITUDE AND WIDTH

NOTE

See Fig. 3-39 for adjustment and pin connector locations for this group.

1. Check/Adjust 2T PULSE Amplitude and Width

Set the FULL FIELD SIG selector switch to SIN^2 PULSE & BAR.

CHECK—2T PULSE amplitude is within 3.57 mV of the BAR amplitude (100 IRE within 0.5 IRE). (Use the 1480 Waveform Comparison controls for this measurement.)

Set the 1480 for 1.0 Volt Full Scale, Mag to .1 μs/Div. Position the half-amplitude point of the 2T PULSE at the horizontal reference graticule line.

CHECK—Ha' Amplitude Duration (HAD) is between 212 ns and 288 ns (250 ns within 15%).

Set the 1480 to 0.2 Volt Full Scale.

CHECK—Ringing after the pulse is 1.25 minor divisions or less (0.5% or less).

ADJUST—L7301, L7401, L7501, L7601 and C7303 for a Half Amplitude Duration of 250 ns within 15%, ringing of 0.5% or less, and symmetrical rise and fall times.

ADJUST R7131 (2T Pulse Amplitude) to match the BAR amplitude exactly (100 IRE).

2. Check/Adjust T PULSE Amplitude and Width

Change the grey connector on P7131 to pins 2 and 3, and the grey connector on P7321 to pins 4 and 5.

CHECK—T PULSE amplitude is within 1% of BAR Amplitude, ringing is 1% or less, and Half Amplitude Duration is 125 ns within 15% (106 ns to 144 ns).

ADJUST—L7311, L7411, L7511 and L7611 for a Half Amplitude Duration of 125 ns within 15%, and ringing of 1% or less.

ADJUST—R7138 (T Pulse Ampl) for the T PULSE amplitude to exactly match the BAR amplitude (100 IRE).

Reconnect the gray connectors for a 2T PULSE (P7131-1 & -2, and P7321-5 & -6).

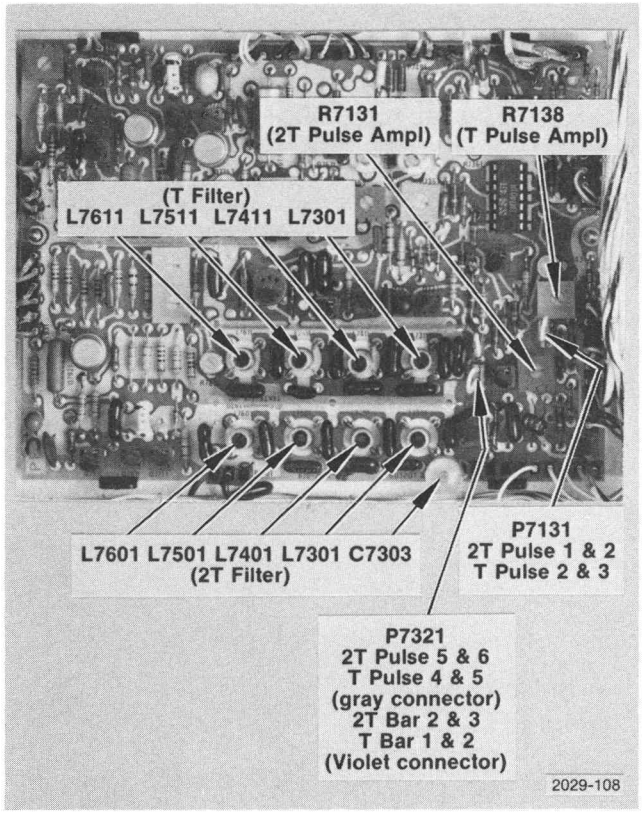


Fig. 3-39. Pulse and Bar adjustment and connector locations.

3. Check BAR Risetimes

CHECK—BAR risetime is 115 ns within 15% (98 to 132 ns).

Change the violet connector on P7321 to pins 2 and 3.

CHECK—BAR risetime is 230 ns within 15% (195 ns to 265 ns).

Return the violet connector to P7321-4 & -5 (T BAR).

CHECK—BAR tilt is 3.6 mV or less in any 10 μs segment (0.5% or less).

GROUP 9—FULL FIELD DIFF GAIN & DIFF PHASE

1. Check Diff Gain

Set the FULL FIELD SIG switch to LINEARITY. Set the vectorscope to measure differential gain.

CHECK—Diff gain is 0.5% or less.

2. Check Diff Phase

Set the vectorscope to measure differential phase.

CHECK—Diff phase is 0.2° or less.

GROUP 10—VIRS SENSITIVITY

Ground P691-9 to energize K9089 (see A10 VITS INSERTION BOARD pull-out, on back side of Diagram 1).

Connect the rear-panel FULL FIELD TEST signal to the PROGRAM LINE IN connector. Display Line 19 of the PROGRAM LINE OUT signal on the waveform monitor. (This enables the BLACK BURST input as described in Section 1.)

CHECK—VIRS display is flickering, and the front-panel VIRS program indicator lamps are flickering. (This indicates that the VIRS Detector is working properly.)

ADJUST—R8030 on the 147A, or R450 on the 149A (VIRS Detect Sens), see Fig. 3-40, to the center of the detection range (flickering). Set the PROGRAM CONTROL UNITY GAIN/VAR switch to VAR. Set the LEVEL control for minimum amplitude. Notice the detector still works. If not, readjust R8030 or R450 for VIRS detection at all positions of the LEVEL control.

Reset the PROGRAM CONTROL switch to UNITY GAIN. Disconnect the FULL FIELD TEST signal from the PROGRAM LINE IN connector, and remove the ground connection from pin 9 of the REMOTE connector, P9014. Return the video signal source to the PROGRAM LINE IN connector.

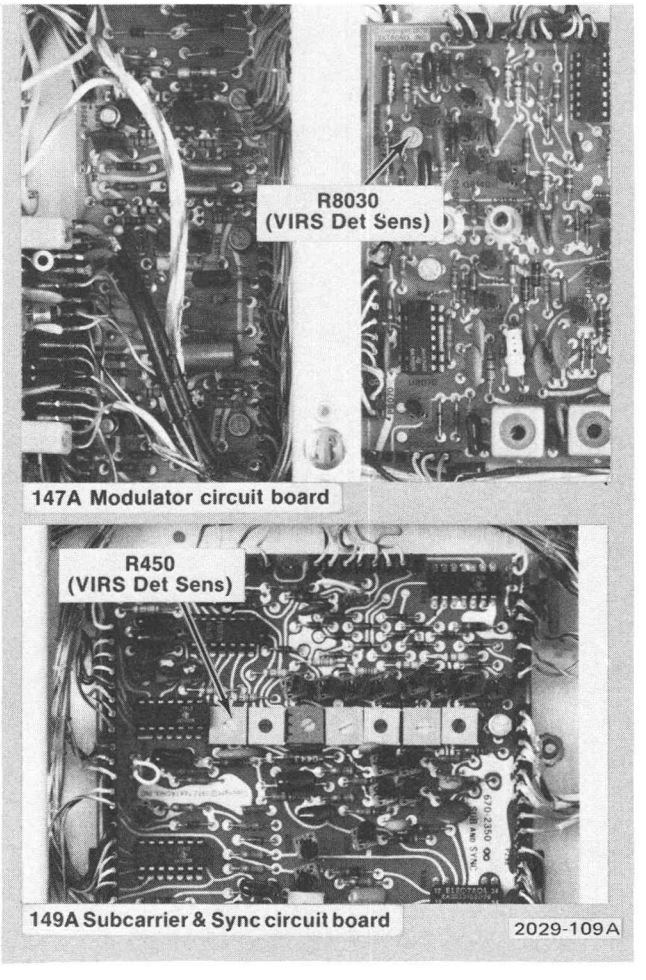


Fig. 3-40. VIRS Detector sensitivity adjustment location.

GROUP 11—GEN-LOCK

1. Check Light and Output Operation

Set the video signal source to provide a modulated staircase VITS on line 19 of both fields. Connect the PROGRAM LINE OUT signal to the monitor, and display the vertical interval.

CHECK—NONSYNCHRONOUS MODE—NO VITS lamp is extinguished; ADD (amber), DELETE (red), and PROGRAM (green) lamps are lit; and there are VITS and the VIR Signal in the vertical interval.

Turn off the video signal source Sync switch.

CHECK—The NON-SYNC lamp is lit; ADD, DELETE and PROGRAM lights are extinguished; and there are no VITS except that from the video signal source.

CHECK—There should be no signal available at the CW SUBCARRIER OUT or COMP SYNC outputs.

Turn the video signal source Sync switch on and the Burst switch off.

CHECK—NON-SYNC, ADD, DELETE and VIRS INCOMING lights are extinguished; PROGRAM light is lit; there are VITS, but no VIRS.

CHECK—There should be no signal available at the CW SUBCARRIER OUT, but there is a signal at COMP SYNC OUT.

Turn the external Burst on.

CHECK—ADD and DELETE lights are on, VIRS is displayed, and there is a signal at CW SUBCARRIER OUT.

2. Check Sync Stripper Operation

Ground pin 9 of the REMOTE connector, P9014, to enable the BLACK BURST input.

CHECK—Loss of VITS and VIRS.

Connect Comp Sync from the video signal source to the BLACK BURST input, do not terminate. Use a 10X probe between the 1480 Probe Input and the test points.

CHECK—TP5290, see Fig. 3-41, for 0.8 V to 1.2 V of sync.

CHECK—P5294, pin 2, see Fig. 3-41, for a composite sync amplitude of 5.0 to 6.0 V.

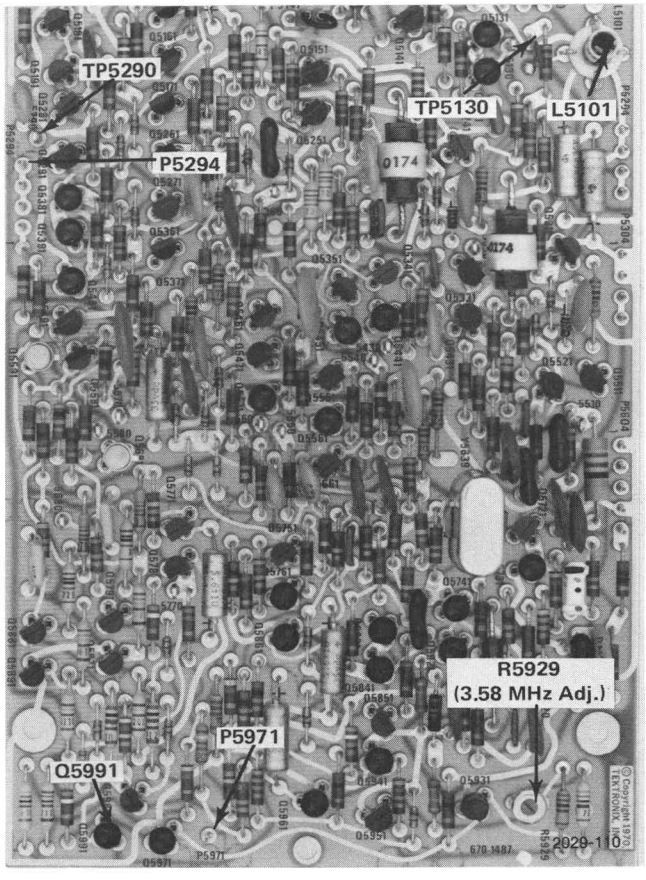


Fig. 3-41. Gen Lock test point, pin connector, and adjustment locations.

Remove the ground connection from pin 9 of the REMOTE plug, P9014.

CHECK—TP5290 should have about the same peak-to-peak signal gain with the video signal source sync on or off, and with either color bars or modulated staircase.

3. Check Chroma AGC Ratio

NOTE

R5929 (3.58 MHz Adj.) is adjusted so that the chroma change is easier to see. It will be reset in step 4.

Connect a 10X probe to TP5130. Remove Q5991 (see Fig. 3-41) and adjust R5929 for a chroma variation of about once a second.

CHECK—Chroma amplitude ratio should not vary more than 1:1.6.

Replace Q5991.

4. Adjust 3.58 MHz Frequency

Monitor the rear-panel FULL FIELD TEST signal on the vectorscope. Turn off the video signal source Burst switch.

ADJUST—R5929 (3.58 MHz Adj.), see Fig. 3-41, for minimum vector rotation (3.579545 MHz within 25 Hz).

Turn the video signal source Burst on.

GROUP 12—VITS INSERTION, DIFF PHASE AND DIFF GAIN

1. Check/Adjust PROGRAM LINE OUT

Set the video signal source for a full-field modulated staircase test signal. Display the PROGRAM LINE OUT signal on the monitor and vectorscope.

Set the vectorscope to measure differential phase.

CHECK—Diff Phase should be 0.15° or less.

Set the vectorscope to measure differential gain.

CHECK—Diff Gain should be 0.2% or less.

2. Check PREVIEW MONITOR OUT

Display the PREVIEW MONITOR OUT signal on the waveform monitor.

CHECK—Diff Gain should be 0.4% or less.

Set the vectorscope to measure differential phase.

CHECK—Diff Phase should be 0.3° or less.

GROUP 13—VITS INSERTION

NOTE

The adjustments and checks in this group, except step 1, require that any errors in the full-field signal be noted or adjusted out.

Display the vertical interval of the rear-panel FULL FIELD TEST signal on the monitor. If the back porch of the Multiburst and Sin^2 Pulse & Bar signals are not superimposed with the blanking level, they will show up as unwanted VITS pedestal error.

Small errors may be adjusted out without further recalibration. Adjust R6942 (MB Sync Level), and R7453 (P & B Sync Level) for horizontal and vertical blanking levels to match in all positions of the FULL FIELD SIG selector switch.

The full-field signal output dc level should be close to 0 volts. Adjust R7733 (DC Level) for 0 volt.

All adjustments, except Auxiliary Sync Level and Ext VITS Gain, are shown in Fig. 3-44.

1. Check/Adjust Auxiliary Sync Level

Display the horizontal interval of the PREVIEW MONITOR OUT signal on the monitor. Set the PROGRAM CONTROL switch to AUXILIARY.

CHECK—Display should be similar to the display shown in Fig. 3-43.

ADJUST—R7361 (Aux Sync Level), see Fig. 3-42, to match the levels as shown in Fig. 3-43.

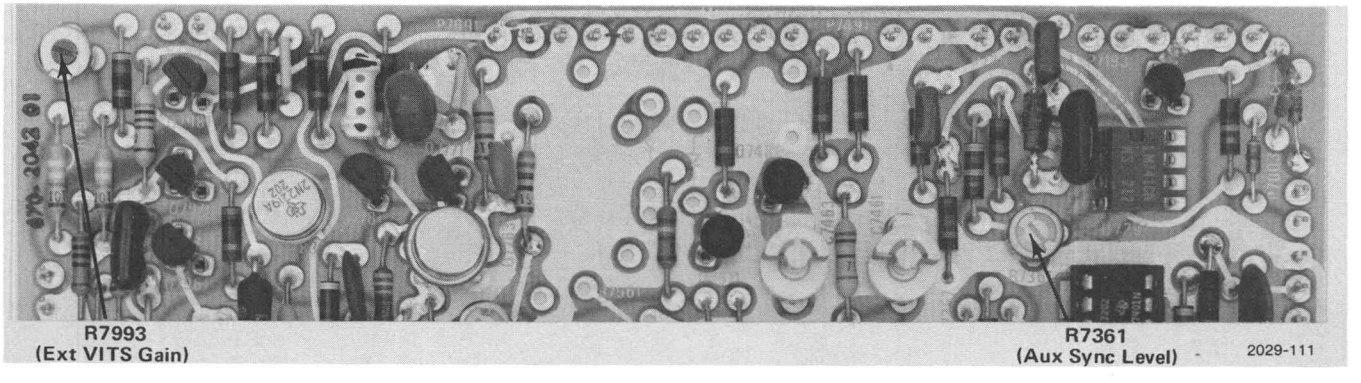


Fig. 3-42. Auxiliary sync level and external VITS gain adjustment locations.

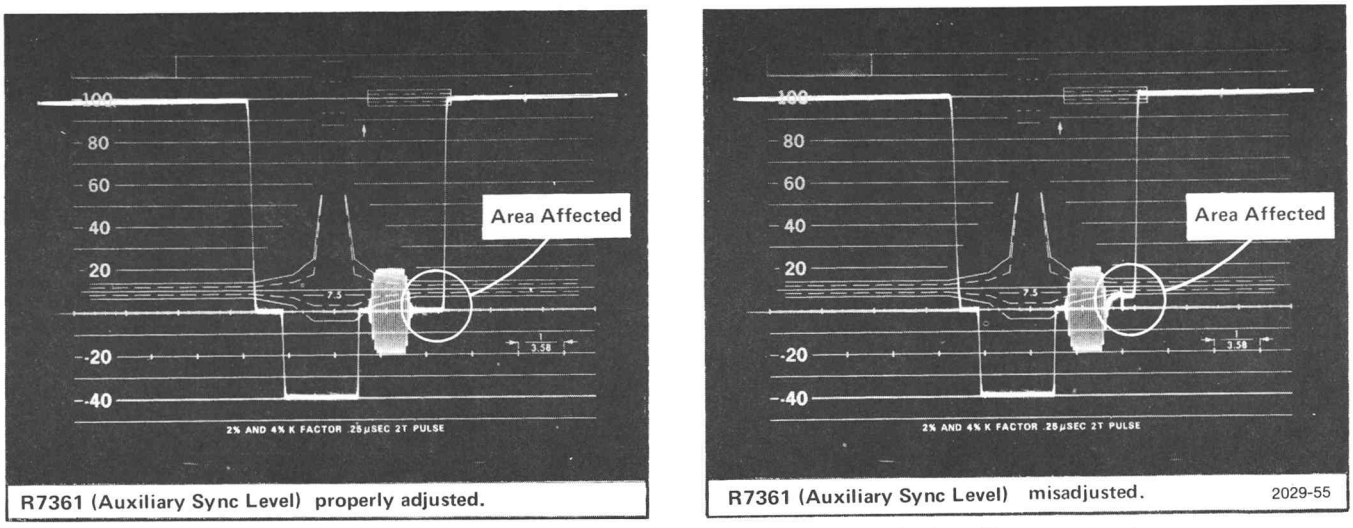


Fig. 3-43. Typical waveform monitor display used to check or adjust auxiliary sync level.

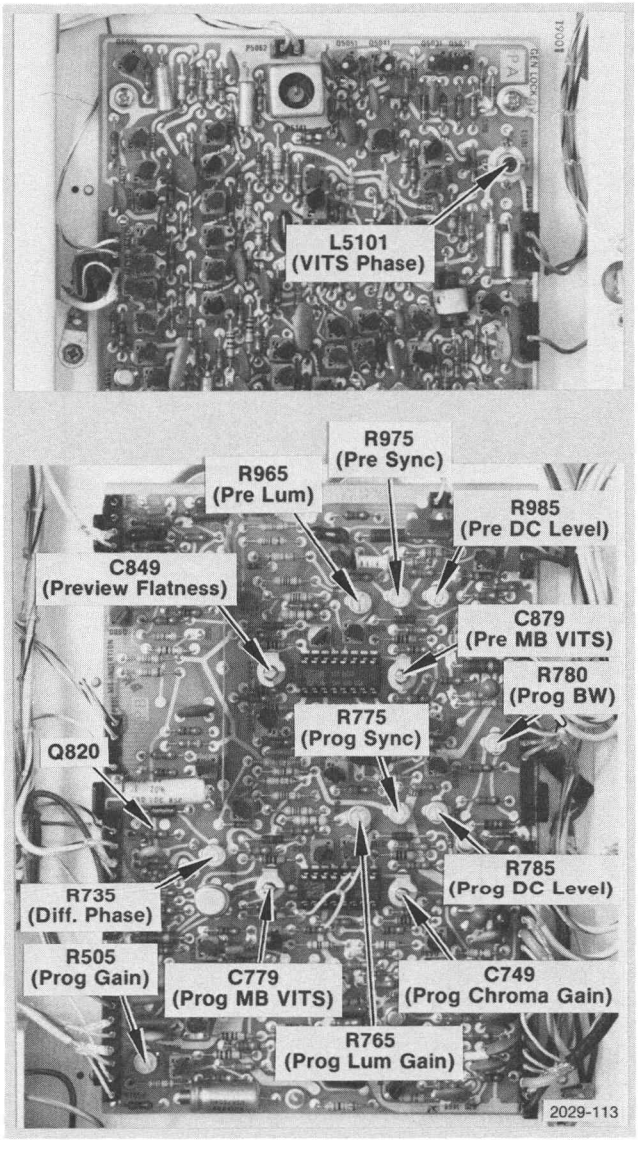


Fig. 3-44. VITS Insertion adjustment locations.

Return the PROGRAM CONTROL switch to PROGRAM.

2. Check/Adjust External VITS Gain

Connect the video signal source (140A) Comp Video to the BLACK BURST input, and connect the loop-through to the EXT VITS IN connector. Set the switch on the modified P9014 (see Fig. 3-44A) so that pins 9 and 12 are connected, pin 12 and pins 21-24 are disconnected. Ground the external ground clip. Set the 140A to provide a 100 IRE Pedestal VITS on Line 16 of Field 2 (or any other convenient line); program the 147A or 149A for this external VITS (see the Operating Changes portion of Section 1 for programming external VITS). Display the vertical interval of the PROGRAM LINE OUT signal on the monitor. After completion of Step 2, return the switch on P9014 to connect pins 12 and 21-24.

CHECK—External VITS amplitude matches the internal VITS 100% levels within 1% (these amplitudes may not actually be 100 IRE at this point; however, the levels should match).

ADJUST—R7993 (Ext VITS Gain), see Fig. 3-42, to match the external and internal VITS 100% levels.

Set the 140 to generate a modulated staircase VITS. Set the vectorscope to measure differential gain on Line 16 of Field 2 of the PROGRAM LINE OUT signal.

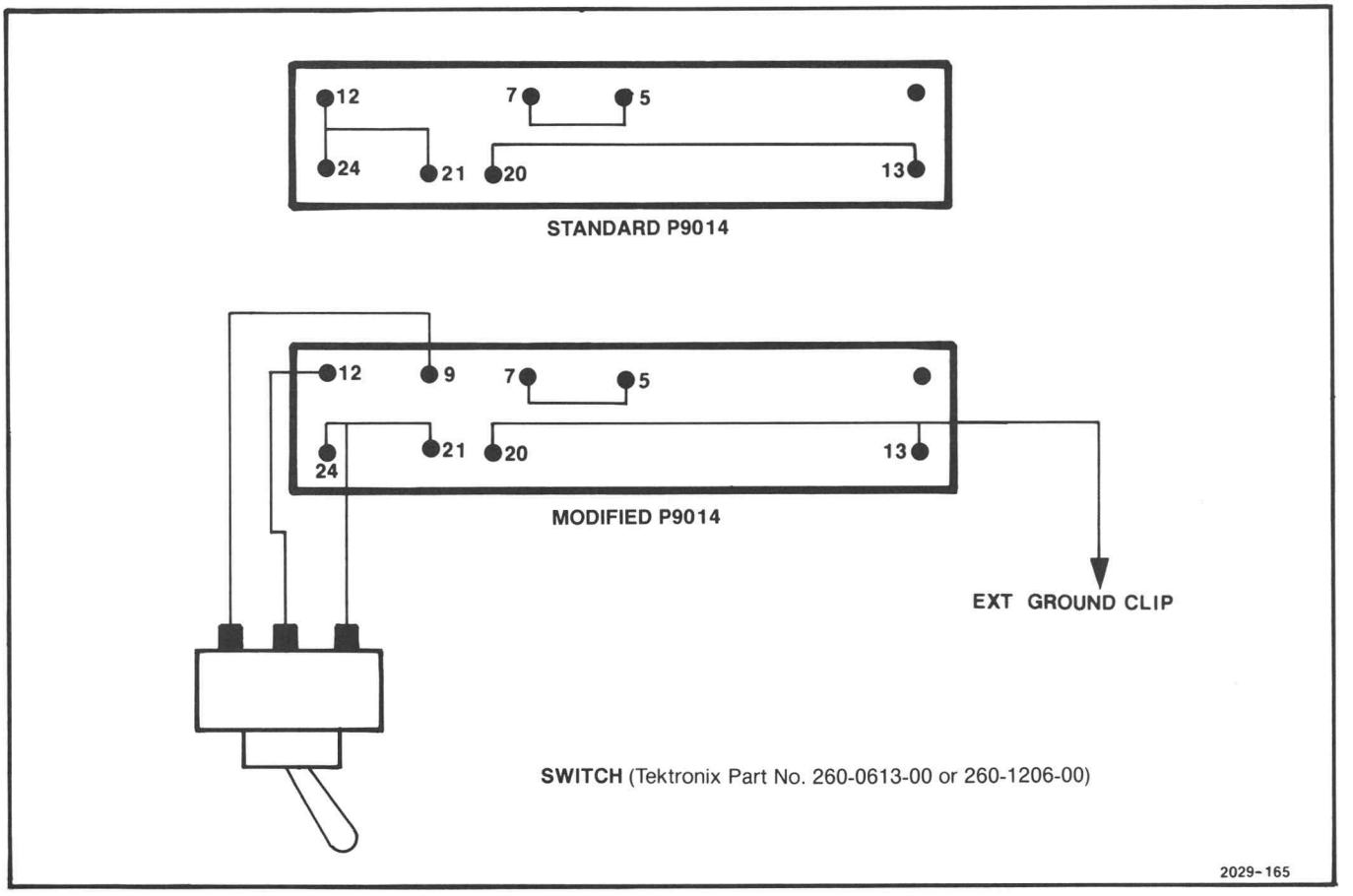


Fig. 3-44A. Modified P9014.

CHECK—Diff gain of the external VITS amplifier is 0.4% or less.

Set the vectorscope to measure differential phase.

CHECK—Diff phase of the external VITS amplifier is 0.3° or less.

Return the VITS Spare 1 programming to Linearity, Field 2, Line 18 (147A) or Line Off (149A).

3. Check/Adjust PROGRAM LINE OUT

Connect the rear-panel FULL FIELD TEST SIGNAL to the PROGRAM LINE IN connector. Display the PROGRAM LINE OUT signal on the monitor.

Set the FULL FIELD SIG selector switch to FLAT FIELD and the VARIABLE APL switch to 100.

CHECK—VITS blanking level and the non-inserted blanking level are within 5 mV of each other (0.7 IRE less).

ADJUST—R775 (Prog Sync Level) to match the blanking levels.

CHECK—Blanking level is 0 volt within 50 mV.

ADJUST—R785 (Prog DC Level) so that no blanking level change occurs when switching between PROGRAM and AUXILIARY (PROGRAM matches 140).

CHECK—VITS 100% amplitudes match the full-field 100% amplitude within 1%.

ADJUST—R505 (Prog Gain) to match the VITS and full-field 100% amplitudes.

CHECK—Full-field pedestal amplitude is 714.3 mV within 1% (100 IRE within 1 IRE).

ADJUST—R765 (Prog Lum Gain) for exactly the same amplitude as the 140 pedestal (100 IRE within 1 IRE).

Set the FULL FIELD SIG selector to MULTIBURST. Remove the FULL FIELD SIG from the PROGRAM LINE IN connector. Display the PROGRAM MONITOR OUT signal on the waveform monitor.

CHECK—Switching transients are less than 5 mV (0.7 IRE).

Reconnect the FULL FIELD TEST SIGNAL to the PROGRAM LINE IN connector. Display the vertical interval of the PROGRAM LINE out signal, showing both the multiburst VITS and the full-field multiburst.

CHECK—VITS and full-field multiburst are flat within 1%.

ADJUST—C779 (Prog MB VITS) so that the tilt of the multiburst VITS is the same when switching between the PROGRAM and AUXILIARY Positions of the PROGRAM CONTROL switch (flat within 1%).

If more range is needed in the adjustment of C779, adjust R895 (Prog Bandwidth) and C779 for the best compromise between a flat multiburst and minimum switching transients.

ADJUST—C749 (Prog Chroma Gain) for the tilt of the full-field multiburst to be the same when switching between the PROGRAM and AUXILIARY positions of the PROGRAM CONTROL switch (flat within 1%).

4. Check/Adjust PREVIEW MONITOR OUT

Note the dc level of the PROGRAM LINE OUT blanking level.

Display the PREVIEW MONITOR OUT signal on the waveform monitor. Set the PROGRAM CONTROL switch to PREVIEW. Set the FULL FIELD SIG selector switch to FLAT FIELD.

CHECK—Preview blanking level should be within 50 mV of the program blanking level.

ADJUST—R975 (Pre Sync Level) so that the VITS blanking level matches the full-field blanking level.

ADJUST—R985 (Pre DC Level) so that the preview blanking level matches the program blanking level (0 V plus any full-field blanking level error).

CHECK—Preview signal overall amplitude should match the program signal overall amplitude within 1%.

ADJUST—R965 (Pre Gain) for a pedestal amplitude of 714.3 mV within 1% (preview signal matches program signal).

Change the cable to display the other PREVIEW MONITOR OUT signal.

CHECK—Preview signal should be the same amplitude.

Set the FULL FIELD SIG selector switch to MULTIBURST. Display the vertical interval, showing both the multiburst VITS and full-field signals.

Change the cable to the PROGRAM LINE OUT. Note the multiburst flatness of the VITS and full-field signals. Return the cable to the PREVIEW MONITOR OUT.

CHECK—Preview VITS and full-field multiburst signals are flat within 1% (same as program flatness).

ADJUST—C879 (Pre MB VITS Flatness) for a flat multiburst VITS (match program flatness).

ADJUST—C849 (Preview Flatness) for flat full-field multiburst (match program flatness).

5. Check/Adjust INSERT SUBCARRIER PHASE

Disconnect the ground from pin 9 of the REMOTE connector, P9014. Disconnect the FULL FIELD TEST SIGNAL from the PROGRAM LINE IN. Connect the video signal source to the PROGRAM LINE IN. Display the PROGRAM LINE OUT on the vectorscope.

CHECK—INSERT SUBCARRIER PHASE control will position the VIRS vector at least 5° on either side of the burst vector; total range should be approximately 28°.

ADJUST—L5101 (VIRS Phase) so that when the INSERT SUBCARRIER PHASE control is centered, the VIRS vector will overlay the VIRS vector on the burst vector.

Display the PREVIEW MONITOR OUT signal on the vectoscope.

CHECK—Preview VIRS overlays on the burst vector.

ADJUST—C849 (Preview Flatness) to overlay the VIRS vector with the burst vector. Recheck multiburst flatness if C849 is adjusted.

6. Check Waveform Tilt

Connect the rear-panel FULL FIELD TEST SIGNAL to the waveform monitor A Input. Connect the front-panel FULL FIELD SIG OUT to the waveform monitor B Input. Set the waveform monitor for 10 μs/Div and DC Cpl'd A-B. Set the FULL FIELD SIG selector switch to SIN^2 PULSE & BAR. Note any tilt (low frequency slope) of the 25 μs Bar.

Connect the rear-panel FULL FIELD TEST SIGNAL to the PROGRAM LINE IN. Ground pin 9 of the REMOTE connector, P9014. Connect the PROGRAM LINE OUT to the waveform monitor A Input.

CHECK—Tilt should be within 0.5% of that noted (3.6 mV or less).

Connect the PREVIEW MONITOR OUT to the waveform monitor A Input.

CHECK—Tilt should be less than 0.5% of that noted (3.6 mV or less).

7. Check PROGRAM and PREVIEW Pulse and Bar

Switch the waveform monitor between the A Input and the B Input.

CHECK—The preview signal is the same as the full-field signal with respect to the following:

2T Pulse-to-Bar ratio;	100% within 0.5%, 3.57 mV
12.5T Pulse-to-Bar ratio;	100% within 1% (147A), 7.14 mV 100% within 0.5% (149A), 2.5 mV
12.5T baseline ripple;	0.5% or less, 3.5 mV

Connect the PROGRAM LINE OUT to the waveform monitor A Input. Repeat the above checks for the program signal.

8. Check AUXILIARY PEDESTAL

Display the PREVIEW OUT signal on the monitor. Set the PROGRAM CONTROL switch to AUXILIARY.

CHECK—AUXILIARY PEDESTAL control range should be from 0 (or less) to 100 IRE (or more).

Connect a 0.1 to 0.5 V signal to the AUX IN input (the video signal source Subcarrier signal via a 10X attenuator is acceptable).

CHECK—The external signal rides on the auxiliary pedestal; it should not affect sync or VITS.

9. Check UNITY GAIN/VAR & LEVEL

Set the PROGRAM CONTROL switch to PROGRAM. Set the UNITY GAIN/VAR switch to VAR. Display the PROGRAM LINE OUT signal on the monitor.

CHECK—LEVEL control range should be from 70 IRE (or less) to 130 IRE (or more).

GROUP 14—TIMING

1. Check INSERT DELAY Range

Display the FULL FIELD TEST SIGNAL on the waveform monitor. Make sure that the waveform monitor Ext Sync is connected to the external video signal source Comp Sync.

Select a reference point on the signal and vary the INSERT DELAY control.

CHECK—Range of the control should be greater than 1 μs.

Leave the control at electrical center.

2. Check/Adjust Pulse Width

Set the waveform monitor to 10 μs/Div Display Rate, and the Mag switch to 1 μs/Div. Display the horizontal blanking interval, and adjust the waveform monitor intensity so that the serration and equalizing pulses can be seen, as shown in Fig. 3-45.

CHECK—Timing accuracy, as measured at the 10% points, is as follows:

Fig. 3-45	Component	Timing
A	Serration Width	4.3 to 4.7 μs
B	Sync Width	4.65 to 4.75 μs
C	Equalizer Width	2.28 to 2.38 μs
D	Horizontal Blanking	

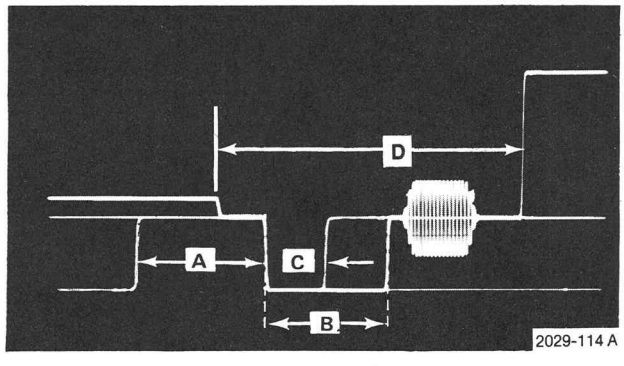


Fig. 3-45. Areas affected by timing adjustments.

ADJUST—Timing accuracy, as measured at the 10% points, as follows: (See Fig. 3-46 for adjustment locations).

Fig. 3-45	Timing
R350 (Serration Width)	4.5 μs
R250 (Sync Width)	4.71 μs
R150 (Equalizer Width)	2.33 μs

3. Check/Adjust Sync Delay

Display the vertical interval of the PROGRAM LINE OUT signal on the waveform monitor. INSERT DELAY control should be at electrical center. Observe the sync pulse of the Multiburst VITS.

CHECK—Timing, as shown in Fig. 3-45 as width D, should be 10 μs within 50 ns.

ADJUST—R1988 (Sync Delay), see Fig. 3-46, for 10 μs.

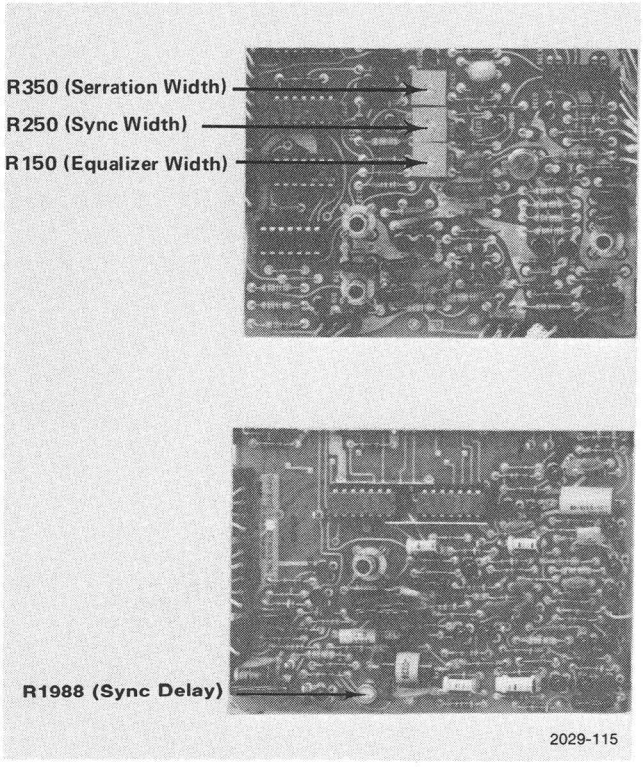


Fig. 3-46. Timing adjustment locations.

GROUP 15—NOISE (147A only)

1. Check/Adjust Noise Amplitude

Connect the 147A NOISE OUT through a 75 Ω coax cable, 4.2 MHz Low Pass Filter, and 75 Ω feed-thru termination to the RMS Voltmeter. Set the NOISE LEVEL dB switches to −20 dB.

CHECK—Noise amplitude is 70 mV RMS within 1%.

ADJUST—R3270 (Noise Bandwidth) fully clockwise, and R3260 (Noise Ampl) for 70 mV RMS.

2. Check Noise Spectrum

Connect a Spectrum Analyzer to the 147A NOISE OUT.

CHECK—Noise spectrum should be flat to 5 MHz within 6 dB.

3. Check Half-Line Insertion

Display the PREVIEW MONITOR OUT signal on the waveform monitor. Set the PROGRAM CONTROL switch to PREVIEW. Set the FULL FIELD SIG Selector switch to NOISE.

CHECK—Half line of noise should be displayed in the middle of the line when in NOISE INSERTION, or a full line of noise pedestal in NOISE DELETION.

4. Check/Adjust Noise Match

Connect Composite Video from the video signal source to the 147A BLACK BURST input, and terminate the loop-thru in 75 Ω. Set the 147A to gen lock to the BLACK BURST input (ground pin 9 of the REMOTE plug, J9014).

Connect the NOISE OUT signal to PROGRAM LINE IN. Set the noise pedestal to match the baseline. Insert −20 dB of noise.

CHECK—Noise amplitudes match.

ADJUST—R7561 (Noise Match) to match the half line noise amplitude to the noise inserted on the program line.

GROUP 16—OPTIONAL CHECKS

This group of checks has been performed at the factory, and may not be desired by the user.

1. Power Supply Regulation

Requires a variable autotransformer.

Repeat the checks given in Group 1, Steps 1 and 2, while varying the autotransformer over the line voltage range listed for the LINE VOLTS selector switch position being used.

2. Return Loss

Requires a return-loss bridge, constant amplitude signal generator and a minimum loss attenuator. See the Optional Test Equipment list. This is to be used in conjunction with the return-loss bridge instruction manual.

Connect the composite video from the video signal source to the BLACK BURST signal. Ground pin 9 of the REMOTE plug, P9014. Externally trigger the test oscilloscope from Comp Sync.

Balance the bridge.

Check return loss with the POWER switch OFF and the PROGRAM LINE OUT connector terminated with the return-loss bridge termination.

CHECK—Return loss should be at least −30 dB (7.9 mV) from 50 kHz to 6 MHz.

Turn the POWER switch ON.

CHECK—Return loss as follows:

PROGRAM LINE IN	−30 dB to 5 MHz
PROGRAM LINE OUT	−30 dB to 5 MHz
PROGRAM MONITOR	−30 dB to 5 MHz
PREVIEW MONITOR (both)	−30 dB to 5 MHz
COMPOSITE SYNC	−30 dB to 3.6 MHz
FULL FIELD OUT (both)	−30 dB to 5 MHz
EXT VITS IN	−34 dB to 5 MHz
AUX IN	−30 dB to 5 MHz

3. PROGRAM LINE OUT Aberrations

Requires an RMS voltmeter, a 5 MHz low-pass filter, and a 5 MHz weighting filter. See the Optional Test Equipment list. A separate 147A or 149A is also required for inserting an external 2T Pulse.

Connect the video signal source composite video to the BLACK BURST input. Ground pin 9 of the REMOTE plug, P9014. (There is no input to the PROGRAM LINE IN). Display the PROGRAM LINE OUT signal on the test oscilloscope.

Residual Subcarrier. Set the PROGRAM CONTROL switch to PROGRAM.

CHECK—Residual subcarrier on lines 10 through 17 and on line 21, of both fields, should be 0.7 mV or less (−60 dB).

Set the PROGRAM CONTROL switch to PREVIEW.

CHECK—Residual subcarrier on lines 10 through 21, of both fields, should be 0.7 mV (−60 dB).

All Blanking Lines and Inactive Parts of Lines. Connect a 5 MHz low-pass filter between the cable and the 75 Ω termination to the test oscilloscope. View the entire vertical interval.

CHECK—Except for programmed VITS, there should be no signal greater than 7.0 mV (40 dB).

Active Parts of Lines. Set the FULL FIELD SIG selector switch to FLAT FIELD and the APL switches to VARIABLE and 0. The 5 MHz low-pass filter remains connected. Display the active portion (10 μs to 62 μs) of any line (22 through 262).

CHECK—Spurious coherent signals should be 0.7 mV or less (−60 dB).

Delete Mode. The 5 MHz low-pass filter remains connected.

CHECK—Active portion of line 21, field 1, for signal attenuation as follows:

Any internal signal (all positions of the FULL FIELD SIG selector switch), −60 dB (0.7 mV or less).

2T Pulse (Pulse and Bar VITS from another 147A or 149A), −70 dB (0.222 mV or less).

Subcarrier (color bar VITS from 140 or another 149A), −60 dB (0.7 mV or less).

Non-Inserted Lines. Connect (from the PROGRAM LINE OUT in listed order) a 75 Ω cable, 5 MHz weighting filter, 5 MHz low-pass filter, 75 Ω termination to the test oscilloscope. Trigger the test oscilloscope on the power input line.

CHECK—Power line transients and hum should be 0.7 mV or less (−60 dB).

Random Noise Output. Terminate the PROGRAM LINE IN connector with a 75 Ω termination. Connect (from the PROGRAM LINE OUT in listed order) a 75 Ω cable, a 5 MHz weighting filter, 5 MHz low-pass fitler, and a 75 Ω termination to the RMS voltmeter.

CAUTION

Check PREVIEW and AUXILIARY modes only. Program signals may damage the voltmeter.

CHECK—Random noise should be 0.14 mV RMS or less (−75 dB).

NOTE

If the above requirement is not met, coherent noise (produced by a clamp pulse circuit) may be at fault. To eliminate the coherent noise, remove Q820 (see diagram 1) and temporarily connect a 5 kΩ resistor between TP801 and ground while making the above check.

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CIRCUIT DESCRIPTION

General

This section describes the electrical operation of the circuits. Most circuits are described as functions performed by the blocks rather than as explanations of the individual parts. Where unusual circuitry is used, a fuller explanation is given. The description is organized with respect to the individual diagrams. Each block described is shown on these diagrams.

The 147A and 149A can be considered as in Fig. 4-1. Basically, they consist of a Relay to provide bypass in the event of loss of sync, instrument malfunction, etc.; Sync and Subcarrier processing circuits to detect synchronization information; Timing circuits to provide gate signals used to generate the output signals; Test Signal Generator to generate the output signals; Program Control Switching to allow the operator to select the mode of operation; Electronic switches to route all signals to the proper outputs at the proper time; and Output Amplifiers to provide sufficient current to drive the outputs.

PROGRAM LINE AMPLIFIER DIAGRAM ①

The circuitry shown on Diagram 1 (Program Line Amplifier) is used to condition the input signal applied to the PROGRAM LINE IN for further processing (required for insertion of signals), and selects the mode of operation.

Relay

Circuitry on the Relay board is used to route the program signal either from the PROGRAM IN connector straight to the PROGRAM OUT connector (bypass), or from the PROGRAM IN connector through the Program Line Amplifier and VITS Insertion circuits to the PROGRAM OUT connector; and to provide various modes of operation if the program signal is lost or Black Burst sync is desired.

Should the program signal be lost, the PROGRAM OUT will be one of two signals: 0 volt (bypass), or Full Field signal. This operational mode is selectable by plug-jumper P9082.

If Black Burst synchronization is desired, Pin 9 of J9014 must be grounded. This actuates two relays. K9080 removes the program line ground, switching to bypass, and K9082 routes the Black Burst signal to the Gen Lock board (Diagram 11) and applies ground to the PROGRAM sync source resistor, R9083.

Q9083 and Q9084 form a "slow on-fast off" relay control circuit. The function of this circuit is to delay energizing relay K9089 during instrument turn-on until the power supplies have risen close to their nominal levels, and to switch the relay to bypass rapidly, as soon as the supplies have started down during power loss.

Q9084 controls the time of relay energizing by time constant C9090-R9090. These components delay turn-on of Q9084 which supplies base current for Q9083.

The rapid switch to bypass when power is lost is a function of C9091-R9091. When the supplies start to fall, C9091 holds the base of Q9083 up. As soon as the emitter voltage falls below the base voltage, the relay is de-energized.

Transmitter Protection

A wire has been added from P301-3 on Diagram 20 to P501-2 on Diagram 2, that gates Program Switch U761, to VIT FULL FIELD channel if incoming sync is lost.

On Diagram 20, composite sync from the Sync Stripper on Diagram 11 is applied through P101-1 to U21B pin 5. When incoming sync is lost, U21B pin 5 goes high, ultimately causing a high output at the collector of Q355. This high is applied through P301-3 and P501-2 to the base of Q658 on Diagram 2.

Q658 is turned off by the high from Diagram 20, saturating Q560 and applying a constant high to pin 4 of Program Switch U761. The program signal out, then, is either flat field or whatever signal is selected by the FULL FIELD SIG Selector switch, as determined by the position of plug-jumper P4642 on the Alt Line APL board.

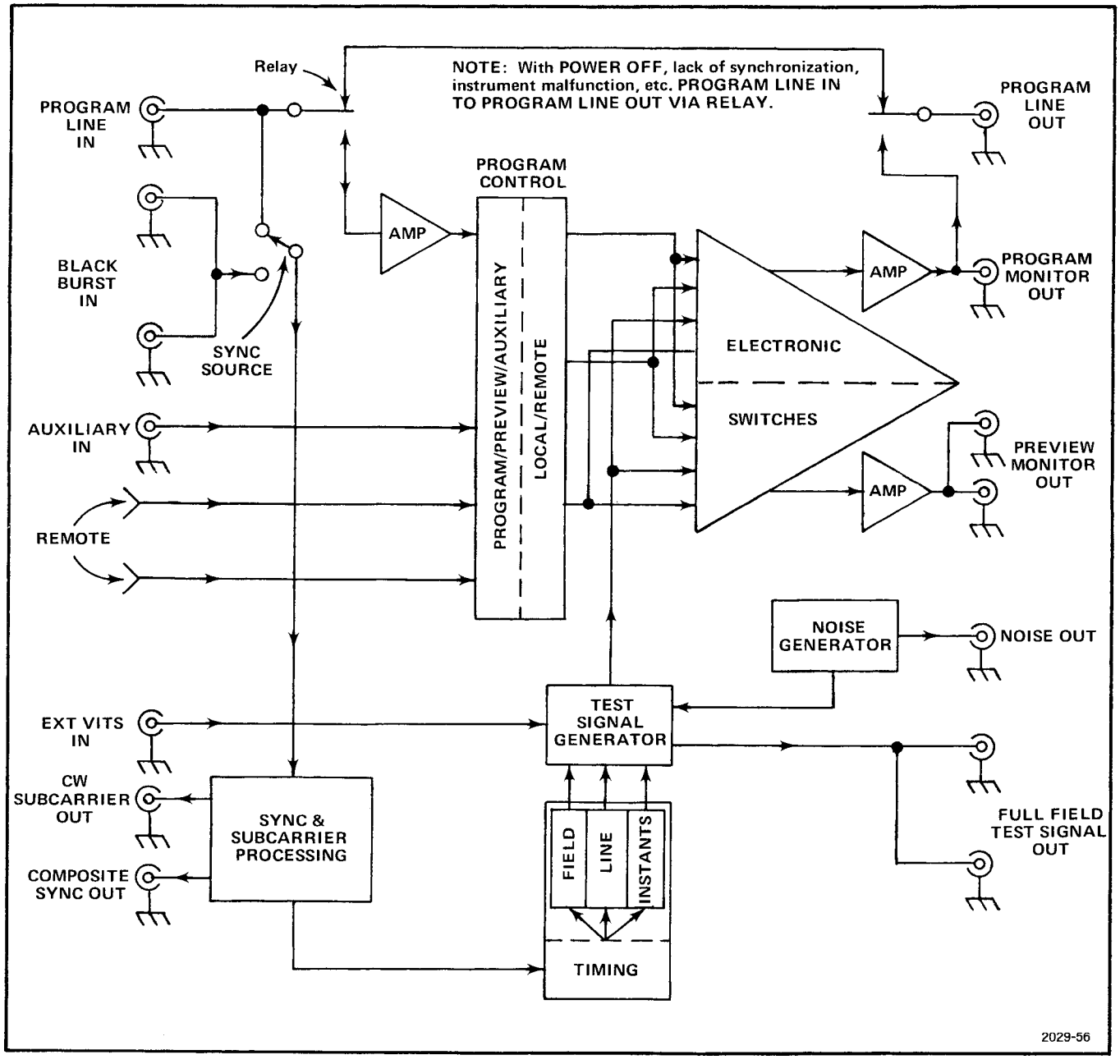


Fig. 4-1. Basic block diagram of the 147A/149A.

Transmitter Protection Delay

C354, in the collector circuit of Q250 on Diagram 20, delays the switch to the VITS & Full Field channel of U761 by a half a second. If half a second is too long a time to provide adequate protection for the transmitter, decreasing the value of C354 will decrease the delay time. A minimum value (15 μF) should be retained in the circuit to avoid relay chatter during turn-on when operating in the Auto Bypass mode. The minimum value of C354 is further desirable to avoid switching to transmitter protection mode with a temporary loss of sync.

Gain

The Gain stage is an ac-coupled operational amplifier with unity gain or variable gain (front-panel LEVEL) of the program signal. Ac coupling removes any dc component that may be applied via the PROGRAM LINE IN.

Q540 provides constant current for emitter coupled amplifier Q510 and Q520. Current through Q520, set by R9205 (LEVEL) or R505 (depending on the setting of UNITY GAIN/VAR, S9205), flows through R625 (R_f of operational amplifier Q620-Q630) to set the overall circuit gain. The signal at TP820 is applied to the VIRS Detector, and to the VITS switches (after dc restoration).

Clamp Pulse Generator

The stage is used to generate a pulse during back porch time to drive the clamps.

Q905, normally on, is driven by composite sync (negative-going). On the trailing edge of each sync pulse, Q905 turns off (current shunted by Q900), producing a pulse which is differentiated by C910 and R926. When Q905 turns back on, the differentiated pulse (which has been delayed from sync), is obtained at the collector of Q920. The pulse-forming circuitry acts like two monostable multivibrators. The first one, consisting of Q900 and Q905, forms the delaying time necessary following the trailing edge of sync. The second monostable multivibrator consists of Q905 and Q920; it forms the clamping pulse.

Clamp

Q820 is the active circuit element of this stage. During back-porch time, it is biased on and effectively grounds TP801. This dc-restores the signal via C804 in the amplifier stage.

Program Control Switching

The two upper sections of S9213 and S9212 determine the signal inputs to the VITS switches on Diagram 2. The lower two sections determine the switching of the Relay Mode signal and VITS switches. For this description, S9212 is assumed to be in the LOCAL position at the start of each explanation. See the Operating Instructions for information about the remote control capabilities of the instruments

The top sections of S9213 and S9212 select the positive signal input to the VITS switches. In the PROGRAM and PREVIEW positions, the output of the Program Line amplifier is connected. In the AUXILIARY position, a dc level determined by AUXILIARY PEDESTAL control R9215, is connected. When S9212 is in REMOTE, the output of the Program Line amplifier is always connected because the AUXILIARY mode is not available in REMOTE.

The second sections of S9213 and S9212 select the negative signal input to the VITS switches. In the PROGRAM and PREVIEW positions, ground is connected from P801-1. In the AUXILIARY position, any signal applied to AUX IN connector J9210, is routed to the VITS switches. The AUX IN signal is fed to the negative input to match the Program Line signal which was inverted by the Program Line amplifier. When S9212 is in REMOTE, ground is always connected.

The third sections of S9213 and S9212 determine the state of the VITS Gate shown on Diagram 2. When in the PROGRAM and AUXILIARY positions, no connection is made to the VITS Gate. This allows CR584 and CR585 to turn off. In the PREVIEW position, ground is connected, turning on CR584 and CR585. When S9212 is in the REMOTE position, ground is connected through the REMOTE connector, J9014.

The bottom sections of S9213 and S9212 determine the state of the Relay Mode signal and the Program switch. In the PROGRAM and PREVIEW positions, ground is connected through REMOTE connector J9014, from relay K9080. This provides a low Relay Mode signal; a low at U761-6, enabling the Program Switch; and energizes relay K9089. In the AUXILIARY position, there is no connection made. This allows current from K9089 to be limited by R598, de-energizing the relay, and turning on Q580. The PROGRAM LINE IN signal is bypassed to the PROGRAM LINE OUT connector, the Relay Mode signal goes high, and the Program Switch is shut off by the high at pin 6 of U761. When S9212 is in the REMOTE position, ground is connected through J9014, from K9080.

Relay Mode Indicator

This stage consists of emitter-follower Q580, and is used to shut off the Program VITS Switch in a Bypass mode. This eliminates any possible cross-talk if the relay

between the PROGRAM LINE IN and the PROGRAM LINE OUT should open.

In the PROGRAM mode, CR585 (Diagram 2) is reverse biased, allowing Q560 to operate as a current source for Q658. The VITS Key signal (through CR588, Q570, and CR664) drives Q658. Q658 drives pin 4 of U761, the Program Switch. Q570 drives pin 4 of U861, the Preview Switch. During the VITS Key signal, the VITS channels of both the Program and Preview Switches are enabled.

In the AUXILIARY mode, the level at P301-3 (Diagram 20) and P501-2 (Diagram 2) is high. CR651 is on and Q658 is off. This keeps pin 4 of U761 low, not allowing VITS to be inserted in the Program signal. Q570 provides the VITS Key to the Preview Switch.

Lamp Drive

Q565, an emitter follower, provides drive for the PROGRAM and PREVIEW lamps.

VITS INSERTER DIAGRAM ②

The circuitry shown on Diagram 2 (VITS Inserter) routes internally-generated and externally-applied signals during selected intervals so that a composite of each is available at the PROGRAM LINE OUT, PROGRAM MONITOR OUT, or PREVIEW MONITOR OUT connectors.

VITS Switches

U761 and U861 are used to route the program signal (or auxiliary signal in the AUXILIARY mode) to the Output Amplifiers, except when VITS is inserted during the vertical interval. During VITS time, the switches route internally-generated signals to the Output Amplifiers as programmed VITS.

Basically, the circuitry acts like two double-pole double-throw switches. In one position, signals applied to pins 2 and 15 reach the differential output, pins 12 and 13. In the other position, signals at pins 7 and 10 reach the output. Switching between the two channels of each switch is dependent upon the condition of pin 4. (See Diagram 2.) Signals reaching the output of each switch are also dependent upon the condition of pin 6 (if high, no output will be obtained). Thus, the incoming program signal (or auxiliary) is applied to one channel, the internal signal to the other; depending upon the Program Control switch settings, a combined output will result.

VITS Gate

As discussed above, VITS switching is dependent upon the condition of U761 pin 4 and U861 pin 4. The VITS Gate stage is used to steer a control signal to pin 4 of each switch so that insertion may occur. Q560, Q570, and Q658 are the active components of this stage.

For the discussion that follows, assume that the PREVIEW mode of operation is selected, and that a VITS is internally programmed to appear during the vertical interval. Under these conditions, the signal at the PROGRAM OUT and PROGRAM MONITOR OUT will be the same as the signal applied to the PROGRAM LINE IN; the signal at the PREVIEW MONITOR OUT is the PROGRAM IN signal, plus the internally-generated and inserted VITS. For these conditions to exist, pin 4 of U761 (Program Switch) must be held low at all times to inhibit insertion in the program channel. In addition, pin 4 of U861 (Preview Switch) must be high during VITS time, and low during the rest of the field.

CR585 and CR588 are forward biased, shunting current away from Q560 and Q570. With Q560 and Q570 off, pin 4 of each VITS gate is low, and only the Program Signal appears at the respective outputs. During VITS time, a VITS Key pulse (via P591-3) reverse-biases CR588 to switch current through Q570. Pin 4 of U861 goes high, allowing the VITS (via pin 7 of U861) to be routed to the PREVIEW MONITOR OUT.

HORIZONTAL COUNTER DIAGRAM ③

Horizontal Integrator, Phase Detector, 1 MHz Oscillator, Divide-By-64 Counter, and Delay

A 1 MHz Oscillator generates a pulse that is counted down to the line rate. The line-rate gate is then compared to the external composite sync. Any timing error between these two signals will produce an error voltage to change the oscillator frequency. This action keeps the ÷64 Counter in step with the external sync.

1 MHz Oscillator. Q1691 and Q1791 are the active components for the 1 MHz Oscillator (actual frequency = 1.006993 MHz). CR1740 and L1670 are the frequency-determining components. Sustaining feedback is provided via C1798 and C1995. The output of the oscillator at TP1480 consists of positive-going pulses (limited sinewaves), which are then used to toggle the Divide-by-64 Counter.

Divide-by-64 Counter. U1391, U1361, and U1431 are flip-flops, connected for a divide-by-2, divide-by-4,..., divide-by-64 sequence. 1 MHz to the input provides outputs at 32H, 16H, 8H, 4H, 2H, and H rates (where H is the horizontal frequency, 15.734 kHz).

Delay. U1461C combines three of the Divide-by-64 Counter outputs to produce a negative gate, approximately 8 μs wide, each horizontal line. During the 8 μs negative interval, this pulse disconnects CR1795 and turns off Q1991, which allows C1780 to charge towards +15 volts (from 0 volt) at an approximate rate of 0.5 V/μs. (Charge path via R1893 and R1760.)

The ramp voltage across C1780 is then compared against the setting of R9209 (INSERT DELAY) and R1988 (Sync Delay) by voltage comparator Q1731 and Q1741. When the ramp voltage exceeds the delay voltage, Q1731 is turned off and a ringing pulse is developed across L1850. This pulse is then peak-detected by CR1930 to drive the Phase Detector.

Phase Detector. Q1921 and Q1721 form the Phase Detector. When Q1921 is turned on, Q1721 acts as a gate that allows the voltage obtained by the ramp in the Horizontal Integrator to be transferred to the variable capacitance diode CR1740, which controls the 1 MHz Oscillator.

Horizontal Integrator. During sync time, this stage produces a ramp that is sampled to control the 1 MHz Oscillator. Composite sync is coupled to switching pair Q1801-Q1811. This switch, during sync time, allows current determined by R1820 to charge C1902 via Q1811 and R1903. This produces a positive (approximately 3 V/μs) ramp, made linear by Q1911. At approximately 4.7 volts positive, Q1901 is saturated to clamp the ramp, preventing breakdown of Q1721 in the Phase Detector circuit.

At the end of sync time, Q1801 is turned on, and current via R1810 causes the ramp at the emitter of Q1721 to go in a negative direction towards 0 volt at an approximate rate of 2.5 V/μs, made linear by Q1911. Ramp voltage at sample time is transferred via the Phase Detector stage to the 1 MHz Oscillator, which brings the ÷64 Counter into step with the external sync.

VITS H Blanking

U1331B and U1461A combine the various timing signals from the Divide-by-64 Counter so that U1301B & C provides the required horizontal blanking that is used to gate (switch) the VIT signals into the PROGRAM signal during VITS time.

VERTICAL COUNTER DIAGRAM ④

Vertical Integrator

The Vertical Integrator produces a ramp during the vertical serration pulses, which is then peak-detected and used to set the Divide-by-525 Counter and Field Recognition circuits. This integrator is similar to the Horizontal Integrator except for circuit values.

On the last vertical serration pulse, Q1411 is biased on, producing one negative pulse per field to drive the Divide-by-525 Counter and Field Recognition circuit.

Field Recognition

U1301A & D and Q1401 are the active components of the set-reset stage, and identify field 1 and field 2.

The circuit is driven by the field pulse (obtained in the Vertical Integrator) every 262.5 lines, and by the 8 μs gate pulse (via the ÷64 Counter) each line. The set-reset stage recognizes field 1 (and changes state) when the 8 μs gate and the field pulse are coincident; no coincidence with the pulse is required for field 2 recognition. See Fig. 4-2 for timing waveforms.

Clock

This stage is driven by pulses corresponding to instants 15 and 31 (see Operating Instructions or Diagram 5 for details). The pulses are used to toggle the Divide-by-525 Counter.

Divide-by-525 Counter

The counter generates the various timing gates required for one-half line offset used in interlace scanning. The counter is initally set to a count of 499 by a pulse obtained in the Vertical Integrator. It is then toggled from the Clock stage, counting to 1024 in a divide-by-2, divide-by-4, ..., divide-by-1024 sequence. On the 1024 count, the counter is reset to a count of 499 (via C1650 and R1632) and the sequence is repeated. (1024 − 499 = 525.)

Matrix

The Matrix produces timing-gate pulses from the Divide-by-525 Counter signals. A typical circuit consists of a pair of gates and a set-reset flip-flop. For example: The 9-Line Keyout signal is generated by U1031, U1331A, and U1201A & D. This signal is used to change sync timing during vertical sync time. The signal duration is from the start of line 1 until the end of line 9 for field 1, and from line 262.5 to line 271.5 for field 2. U1201A & D, a set-reset flip-

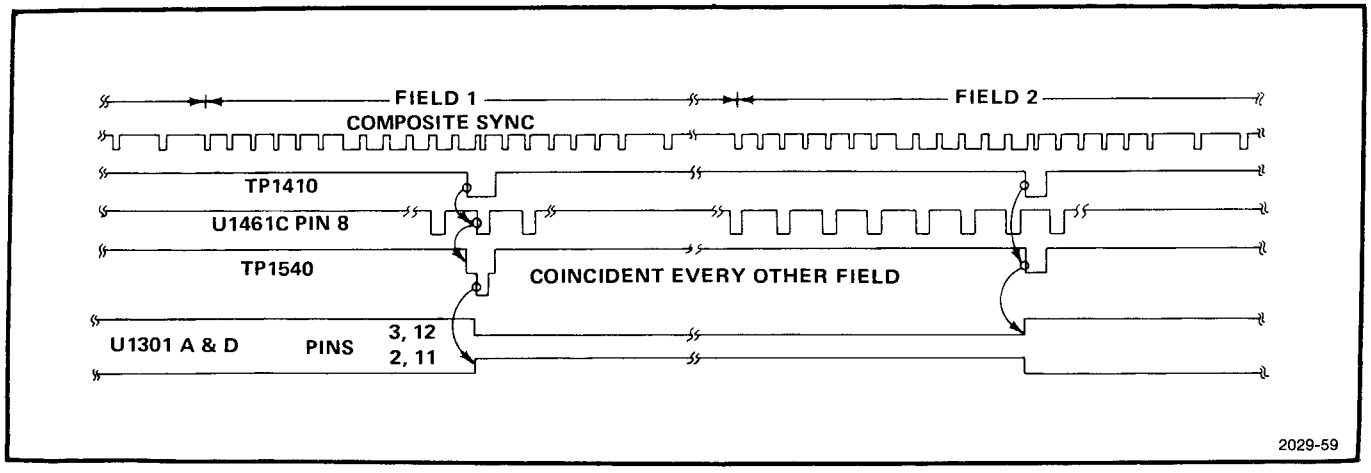


Fig. 4-2. Field recognition timing waveforms.

flop, will change states when the first low is received at the set input. It won't change states again until a low is received at the reset input. U1031 provides the set enable when all of its inputs are first high. This happens at the start of line 1 and at line 262.5. U1331A provides the reset enable when all of its inputs are first high. This occurs at the end of line 9, and at line 271.5.

Other signals generated by the Matrix are produced in the same way as the 9-Line Keyout. The Vertical Blanking signal duration is line 1 through line 21. The Field Square Wave signal duration is line 57 through line 227. The Window enable signal duration is line 66 through line 218.

HORIZONTAL TIMING (Matrix and Flip-flops) DIAGRAM ⑤

The Horizontal Timing circuitry shown on Diagram 5 is divided in two parts. The Instant Decoder combines the various signals from the Horizontal Counter into the characteristic timing instant pulses required to drive the set-reset flip-flops. The set-reset flip-flops provide pulses of necessary widths to drive the signal generator circuits.

Instant Decoder

U2001 and U2401 are decoders which generate the characteristic timing instants. These instants are used to drive circuits which determine the horizontal timing of the test signal elements.

The decoders require a low at each gate input, G1 and G2, in order to give an output. One of the gate inputs of each decoder is driven by a 503.5 kHz square-wave signal. The other gate input of U2001 is driven by a 15.734 kHz square-wave signal which is low during instant 3 through instant 18. The remaining gate input of U2401 is driven by a 15.734 kHz signal which is low instant 19 through instant 2. Therefore, U2001 is enabled at a 503.5 kHz rate for about 32 μs during the first part of the line, and U2401 is enabled at the same rate for the remaining part of the line.

The A, B, C, and D inputs of each decoder are driven by signals from the Horizontal Counter as follows:

A 251.75 kHz
B 125.9 kHz
C 62.9 kHz
D 31.5 kHz

Each input signal is a square wave, going low corresponding to instant 3. The input signals are combined by the decoder and provide one pulse per line period at each of the outputs.

Each output corresponds to a characteristic timing instant. The instants start at about 2 μs intervals (63.56 μs/32 = 1.986 μs), and each pulse is about 1 μs wide (or one-half of 1.986 μs).

Set-Reset Circuits

There are 23 set-reset flip-flops on the Horizontal Timing circuit board. There are 12 shown on Diagram 5, and 11 shown on Diagram 6. All are identical in operation.

Each circuit consists of two NAND gates wired as a set-reset flip-flop, as shown in Fig. 4-3. Both inputs are normally high. When a negative-going pulse occurs at the Set input, the 1 output goes high, and the 0 output goes

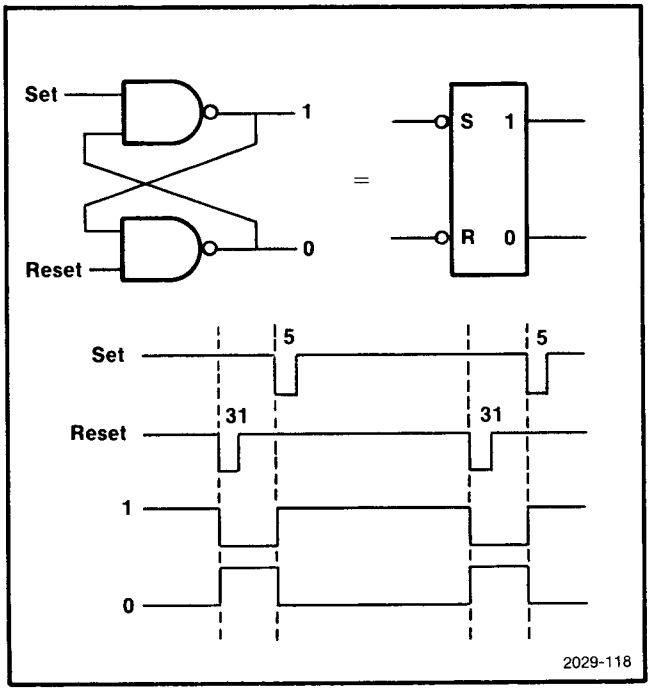


Fig. 4-3. NAND gates wired as a Set-Reset flip-flop, illustrating the formation of the H Blanking signal.

low. When the Reset or Clear input receives a negative-going pulse, the outputs change states. This results in a pulse at the outputs with a width corresponding to the difference in timing of the pulses at the inputs.

For example, H Blanking circuit U2061A & B receives a pulse at the Set input at instant 5, and a pulse at the Reset input at instant 31. Therefore, the signal at the 1 output is high between instants 5 and 31, and the signal at the 0 output is high between instants 31 and 5.

HORIZONTAL TIMING (Signal Timing Logic) DIAGRAM ⑥

Set-Reset Circuits

The Set-Reset circuits on Diagram 6 are identical to those described for Diagram 5.

1/2 Instant Timing

The Composite signal requires several timing pulses that are offset by 1 μs from a timing instant. Instants 8 and 11 are inverted and combined by U2961D, and differentiated by C2958, R2934, and R2932. Instant 14 is inverted by U2931E, and differentiated by C2936, R2922, and R2920. The negative-going differentiated pulses provide the 1 μs offset for the Composite timing corresponding to instants 8.5, 11.5, and 14.5.

Staircase Logic

U2831 and U2961C are negative-input OR gates, driven by the 10 timing instants required for the 10 Step Staircase test signal. The outputs of the two gates are combined on Diagram 8.

U2861 combines the timing instants and half-instants needed to drive the staircase generator for the Composite signal.

U2981C is a NAND gate that provides the Staircase Enable signal. The Composite Enable from Diagram 18 is low for the Composite signal to be generated. U2931D inverts the Composite Enable, causing pin 9 of U2981C to go high. Pin 8 of U2981C is high between instants 4 and 16. Therefore, the Staircase Enable signal is low between instants 4 and 16 when the Composite signal is programmed.

U2981B generates a low Linearity Subcarrier Enable between instants 5 and 14.5 when the Composite signal is programmed.

U2981A generates a low Linearity Subcarrier Enable between instants 5 and 29 when the Linearity signal is programmed.

Burst Width

Timing instants, corresponding to the start of each Multiburst packet, are fed to negative input OR gate U2741. The resultant signal is inverted by U2931C, and drives monostable multivibrator U2811A (149A), or U2811 (147A). The multivibrator is enabled when the MB Enable signal is high.

When the multivibrator is enabled, each pulse at the input generates a pulse at the output. The output pulse width is determined by C2722, R2724, and R2720-R2715. R2724 is only connected in the circuit between instants 16 and 1. Therefore, the first two packets are longer than the last four packets.

The output of the multivibrator is inverted by U2911B (the other input of U2911B is high for Multiburst), and becomes the Function Generator Enable for Multiburst.

Modulated Pulse Timing

The P & B Enable is inverted by U2931B to be low for the Sin^2 Pulse & Bar and Window signals. Composite Enable is low for the Composite Signal. The two enables are combined by U2911D to form the Mod Pulse Switching signal.

When the Composite signal is to be generated, pin 5 of U2721 is low, inhibiting the P & B Mod Pulse Timing at pin 4 from passing. The Composite Mod Pulse Timing at pin 3 of U2721 will pass through the gates and drive the pulse forming circuits. Alternatively, when the Sin^2 Pulse & Bar or Window signals are to be generated, the Comp Mod Pulse Timing will be inhibited, and the P & B Mod Pulse Timing will pass.

The pulse-forming circuit in the 147A consists of Q2710, C2708, R2703, and U2931A. In the 149A, the Function Generator Enable pulse is formed by U2811B, with the timing determined by C2810 and R2820. The output of the pulse circuits is inverted by U2911B (the other input of U2911B is high for all signals except Multiburst), and becomes the Function Generator Enable signal for the modulated pulse.

Pulse Timing

The lower half of U2721 operates in the same manner as was described for the upper half. The Pulse Timing at the output of U2721 is determined by the Composite and P & B Enables. U2931F inverts the output signal, and provides the Pulse Enable to Diagram 16.

U2931D inverts the Composite Enable signal, and feeds it to the Staircase Logic circuit and the Bar Timing circuit.

Bar Timing

U2911A and U2911C determine the bar timing for the Composite, Window and Sin^2 Pulse & Bar signals. The outputs of the two gates form a wired OR circuit. When the Composite signal is to be generated, pin 8 of U2911C is high, allowing the Composite Bar Timing (instants 22 to 31) to be inverted, thus becoming the Bar Enable signal. When the Window signal is to be generated, the Window Enable at pin 2 of U2911A is only high during lines 66 through 218. When the Sin^2 Pulse & Bar signal is to be generated, the Window Enable is high during the entire active field.

NOISE GENERATOR (147A) DIAGRAM ⑦

Noise Generator

This stage uses the thermal characteristics of two resistors (R3285 and R3383) to generate noise.

Noise Preamp

Q3360-Q3370 and Q3240-Q3250 are operational amplifiers. They provide about 70 mV of noise at the collector of Q3240. C3251 and R3270 affect the low-frequency cutoff so that the noise spectrum is flat (within the tolerance listed in Section 1).

Noise Amplitude Switching

This stage provides front-panel (NOISE LEVEL dB) dc control of the noise signal.

The 1 dB switch (S9240, located on the front-panel) controls the current through the emitters of U3100A and B, which are connected as diodes. The impedance between pin 6 of U3100C and pin 9 of U3100D is set by this current (e.g., increased current reduces the impedance, and less signal is allowed to pass through the noise amplifier).

The 10 dB switch (S9235) provides a forward-bias source for Q3040, Q3050, Q3060, and Q3070. Turning on one of these transistors grounds its collector. As these transistors are connected to a resistor string composed of R3141, R3163, R3171, and R3183, they set the impedance to ground at the base of Q3130. The amplitude of the signal seen by Q3130 is controlled by this impedance. Q3130 and Q3110 are emitter-followers to provide low impedance outputs.

COLOR BAR DRIVE (149A) DIAGRAM ⑦

The circuits on Diagram 7 of the 149A provide currents which correspond to the R-Y, B-Y, and luminance (y) portions of the Color Bars signal, and the 50 IRE luminance pedestal of the Modulated Pedestal signal. (See Fig. 4-4 for Color Bar Drive timing information.)

Color Test Signal Logic

These circuits provide enable signals to chrominance and luminance counters, U3220 and U3230.

U3010B enables the luminance counter when S9225 is in the Color Bars position.

With S9225 in Color Bars, and S9230 in Split Field, U3010A & C enable chrominance counter U3220 only during the Window time, lines 66 through 218. When S9230 is in Full Field, the chrominance counter is enabled for the entire active field.

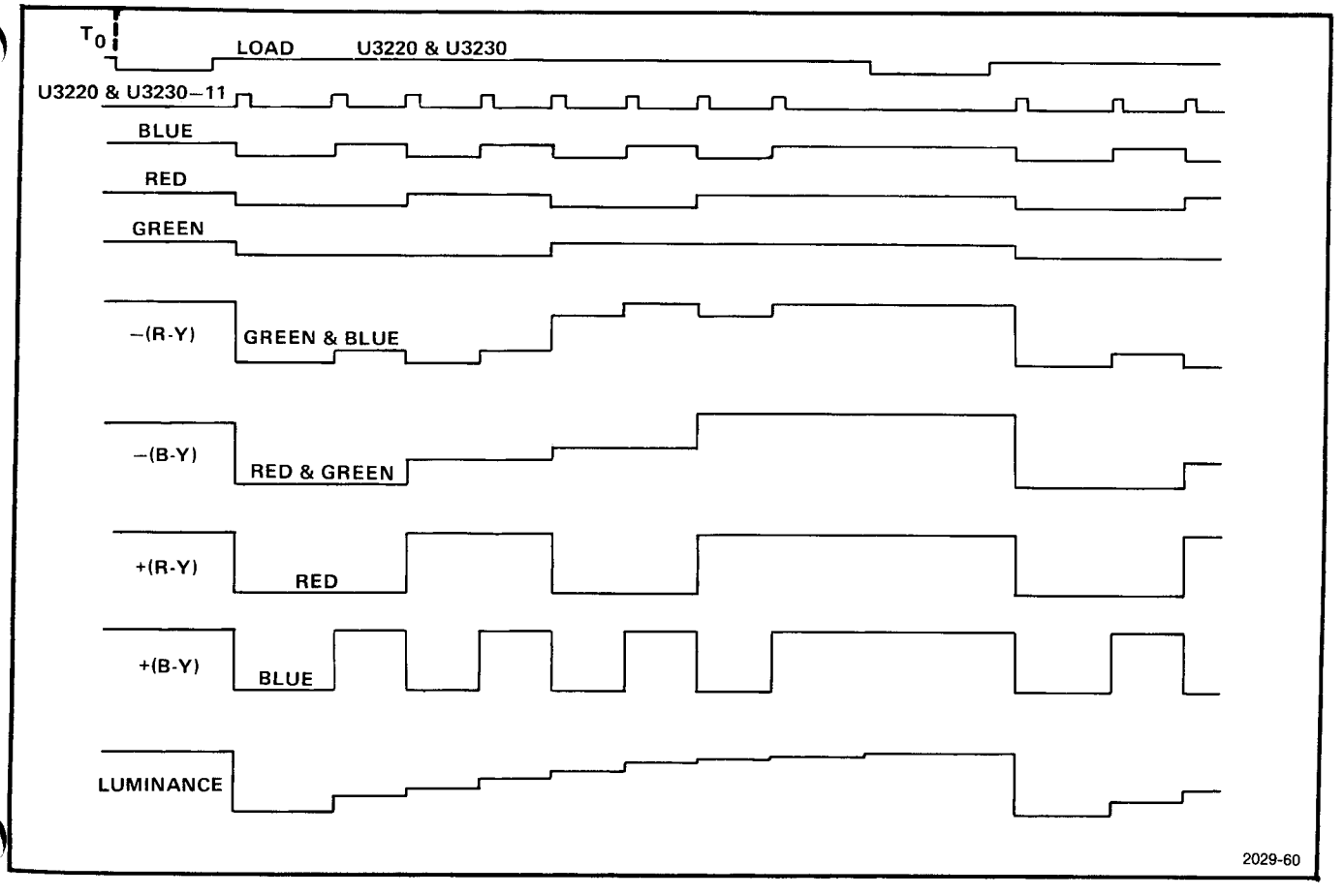


Fig. 4-4. 149A Color Bar Drive timing waveforms.

Color Bar Timing

U3210 combines the timing instants required for the Color Bar chrominance and luminance signals, and feeds the Chrominance Drive and the Luminance Delay circuits.

Color Bar Chrominance Drive

U3220, a synchronous counter, provides timing outputs corresponding to the Blue, Red, and Green chrominance signals.

Color Bar B-Y Amplitude

Q3050, Q3060, and Q3070 provide the current to the modulator to form the B-Y chrominance signal. The amount of current through each transistor is determined by the emitter resistors.

Color Bar R-Y Amplitude

Q3020, Q3040, and Q3030 are the R-Y current switches. Their emitter resistors set the appropriate current for the R-Y modulator sections.

Delay

Q3367 introduces a variable amount of delay (approximately 200 ns) so that the luminance and chrominance components of the Color Bar signal are properly combined at the output.

Luminance Amplitude

This stage is similar to the Color Bar Amplitude stages, except that currents derived in this stage correspond to the luminance (y) portion of the Color Test Signal, or the luminance level of the Modulated Pedestal.

STAIRCASE & APL DIAGRAM ◈8

Field Square Wave

This stage causes the Field Sq. Wave signal to begin and end coincident with the beginning and end of

horizontal lines in both fields. The Field Sq. Wave signal input to this circuit comes from the matrix circuit on Diagram 4, and is offset 1/2 line in field 1.

U3585A is an edge-triggered D flip-flop. The data input (pin 2) is programmed by a high during lines 57 through 227, and a low during the remaining lines. Pin 3 is triggered by the positive transition of the H Blanking signal. The output on pin 5 is the Field Sq. Wave timing signal to the APL circuit.

Window

This circuit is similar to the Field Square Wave, except that its output is the Window signal. The data input of U3585B (pin 12) is programmed by a signal that is high during lines 66 through 218.

Bounce Generator

This circuitry consists of a modified Bowes Oscillator (Q3890 and Q3880), which is front-panel controlled (RATE). This allows the oscillator period to be changed from approximately 1 to greater than 10 seconds. The output of the bounce oscillator is used to control the data input of flip-flop U3855B. This flip-flop is clocked by horizontal blanking so that the bounce transitions will take place coincident with the start of a line. On the 149A, jumper P3926 selects the toggle input of U3855B to be either H Blanking (pins 1 and 2), or Field Square Wave (pins 2 and 3). When the Field Square Wave is selected, the Bounce signal will start on line 57 of whichever field it switches on, or the next field. The outputs of U3855B are used to control NAND gates U3835D and U3735C.

Bounce Current Generator

This stage consists of three current switches to set the level of the FLAT FIELD test signal. Q3825 supplies the 10% current, Q3820 supplies the 90% current, and Q3720 supplies the current for the variable. The diodes located in the collector circuit of each current source switch the current on or off; the diodes in the emitters control the switching between 10%, 90% and VARIABLE APL.

Linearity Logic

This stage combines timing and gate signals for the control of staircase and ramp generation for the LINEARITY and COMPOSITE signals.

U3735A produces a low output on pin 3 to enable the integrator circuit when pins 1 and 2 are both high. U3735B produces a high output on pin 6 when either pin 5 is low (for COMPOSITE) or pin 4 is low (for LINEARITY).

U3775A produces a negative-going pulse on pin 3 when pin 2 is high and pin 1 is pulsed high. U3755C inverts the low pulses from U3875C.

U3875C produces negative-going pulses when pin 8 or pin 9 senses positive pulses from circuits shown on Diagram 6. U3875B produces a high output on pin 4 when pin 5 is low, and S9270 is in the 10 STEP position, grounding pin 6.

U3775A produces positive-going pulses for either 5 STEP LINEARITY or COMPOSITE signals. U3855A divides the 10 Step timing by 2 for 5 STEP LINEARITY. U3875A pin 1 is high to enable U3855A when pin 2 and 3 are both low.

U3855A produces a low on pin 3 for RAMP when pins 2 and 1 are both low (S9270 enables U3875D when RAMP is selected).

The 5 Step timing for COMPOSITE feeds U3775B, which is enabled by the Staircase Enable signal. Pin 10 of U3775C is high for COMPOSITE, so the timing is passed to the 5 Step Amplitude circuit.

If P3760 is reversed, the Ramp signal will be generated in place of the 5 Step staircase on the COMPOSITE signal. The Staircase Enable signal is routed to U3835A. Since the Staircase Enable is high at pin 1 of U3835A only during the Staircase time of the COMPOSITE signal, the timing to the Ramp Amplitude circuit corresponds to the Staircase Enable timing.

Generator Enable

The Generator Enable circuit allows the Linearity Generator circuit to operate only when a Staircase or Ramp signal is to be generated (either LINEARITY or COMPOSITE). At all other times, the Generator Enable will short the input and output of the Linearity Generator.

The circuit consists of Q3520, Q3510, Q3600, Q3540, CR3531, and CR3533. When U3735A produces a low at the output, CR3533 conducts and disconnects CR3531. Q3520 increases conduction and shuts off Q3540. The Linearity Generator can then accept drive from the Linearity Amplitude sources.

When the output of U3735A goes high, Q3520 shuts off, and Q3510 conducts, turning on Q3540. Q3540 conducts through CR3531, resetting the Linearity Generator and disconnecting CR3533.

Q3600 clamps the base of Q3540 at about +0.6 volt. Feedback from the Linearity Generator output to the emitter of Q3540 maintains the quiescent 0 volt output level.

Linearity Generator

This stage generates the ramp and staircase waveforms. The circuit is an Integrating Amplifier, and consists of Q3440, Q3430, Q3530, and feedback capacitors C3441 and C3443.

The gate of Q3440 is a high impedance, and will accept very little current. Therefore, the current from the Linearity Amplitude circuits must go through the feedback capacitors, and Q3430 and Q3530 must provide the voltage required at the opposite end of the capacitors to satisfy the requirements of current flow in capacitors:

$$(i = C\frac{dv}{dt}).$$

Linearity Amplitude

This stage drives the Linearity Generator. There are three circuits; the 10 Step Amplitude, the 5 Step Amplitude, and the Ramp Amplitude circuits.

The 10 Step Amplitude circuit drives the Linearity Generator when the 10 Step signal is to be generated. Each time the output of U3775A goes low, Q3470 conducts and discharges C3470 and C3461 through Q3450. The current through Q3450 drives the Linearity Generator, producing a negative voltage step for each pulse at the input.

The 5 Step Amplitude circuit is similar to the 10 Step circuit, except that C3565 and C3473 have a parallel capacitance about twice that of C3470 and C3461, so that the 5 Step staircase has the same adjustment range as the 10 Step staircase. C3467 can be connected into the circuit if additional adjustment range on the higher amplitudes is needed.

The Ramp Amplitude circuit supplies a dc current, rather than pulses, to the Linearity Generator. When the output of U3755D goes high, CR3651 is disconnected. R3616 and R3621 set the current through Q3645, which drives the integrator. A negative-going linear ramp is generated by the Linearity Generator.

Linearity Modulation Amplitude

This stage is a programmable current switch (Q3420 and CR3411) that provides sufficient current to the modulator for either 140 mV or 280 mV subcarrier modulation on the LINEARITY test signal.

VITS LOGIC DIAGRAM ⑨

The circuits on Diagram 9 determine which lines will contain VIT signals, and which signals will be on those lines.

Line Counter

The line counter establishes gating signals corresponding to each of the available VITS lines.

U4471 is a 4-bit binary counter. The trigger input is a characteristic instant corresponding to time 0, and occurs once every line.

U4351 converts this binary code to decimal output. Both the G1 and G2 inputs must be low for U4351 to operate. The G2 input is connected directly to the vertical blanking signal, so that the decoded VITS line pulses will be present only during the vertical blanking interval. The G1 input is enabled by the Sync Reset circuit.

Sync Reset

This circuit prevents any VITS from being inserted into the vertical interval if a loss of vertical sync should occur.

U4661B and D form an R-S flip-flop. When set, the 0 output enables the VITS & AUX circuit, and the 1 output enables G1 of U4351. When reset, these outputs are inverted, inhibiting the VITS & AUX circuit and U4351.

Vertical blanking is differentiated by C4460 and fed to the Set input to inhibit the VITS line decoder at the start of every vertical blanking interval. A negative pulse from the Vertical Integrator, shown on Diagram 4, resets the flip-flop when incoming vertical sync has been processed for the counters.

VITS Line and Field Matrix

This stage selects lines and fields for insertion of the various VIT signals.

Each row of pin pairs corresponds to a particular test signal. The 3 columns at the extreme left correspond to fields, and the remaining columns correspond to individual lines. Programming plugs placed on the matrix connect selected line and field information to AND gates U4741B, U4621C, U4621D, U4621B, U4621A, and U4741C.

When one of the AND gates senses a low on both inputs (line on one, field on the other) the output goes high. The inverter makes this a low enable for the VITS Key circuit.

VITS Key

This circuit develops the switch control signal for the circuitry on Diagram 2. A high is generated when VITS, Sync and Burst, or Auxiliary signal are to be inserted.

VITS line and field information drives U4821. The output of this gate is combined by U4761A with VITS H Blanking and the Sync Reset signal. The resulting signal drives U4681C.

U4622A & D, a set-reset flip-flop, is set by a signal going low at line 16, and reset by the differentiated trailing edge of Vertical Blanking. The 0 output of the flip-flop is combined with inverted Vertical Blanking by U4622C. This combined signal is low between lines 16 and the end of Vertical Blanking. U4641D combines VITS H Blanking and the output of U4622C. This signal drives U4661C, and is gated through, or stopped, by the signal from pin 2 of P4780, shown on Diagram 10.

The output of U4681C provides the VITS Key signal.

Alternate APL

This circuit controls the FLAT FIELD and Full Field signals when the ALT APL mode is selected.

U4662 is a divide-by-2 and divide-by-5 counter. The reset input is driven by the differentiated pulse of a line 21 signal, on field 1 or field 2. The clock input is driven by timing instant 0, causing the counter to count by 2 lines and 5 lines.

Either the divide-by-2 or the divide-by-5 output is selected by the jumper on P4662. The selected output signal goes to S9290, the Full Field mode switch. In the ALT APL position, the signal feeds U4642C and U4642A. The level at the other input of these gates is normally high. The output of U4642C inhibits the selected Full Field signal for the lines enabled for the FLAT FIELD signal. The output of U4642B drives U4171A, shown on Diagram 10, enabling the FLAT FIELD signal every other line, or for four lines out of every five, as selected by P4662.

When Program sync is lost, and the 147A or 149A is in the Transmitter Protection mode, the level at pin 1 of P4642 is low. If the jumper on P4642 is connected to pins 1 and 2, gates U4642A and U4642C are disabled, allowing only the FLAT FIELD signal to be generated. If the jumper on P4642 is connected to pins 2 and 3, the Full Field position, the gates will be enabled, and the front-panel selected Full Field signal will be generated.

Modified Vertical Blanking

This circuit shifts the Vertical Blanking signal so that it ends on line 22. This inhibits the first and last half of line 21 from being generated during Full Field signals.

VIRS Detector

The first stage of the VIRS Detector circuit is shown on Diagram 19. The VIRS Detector logic circuitry determines whether the signal being detected is actually a VIR signal, or some other signal; and drives the VIRS INCOMING lamp circuit, the Opposite Field VIRS Preview circuit, and the VIRS Insertion on Monochrome circuit (discussed with Diagram 10).

If chrominance is detected between instant 6 and 18, the Data input of U4271B will go high. However, if the chrominance is still present after instant 18, meaning the signal present is not VIRS, the Data input will return low. The clock pulse input goes high at line 21 of the field selected by the VIRS Detection Field jumper, P4140. The 1 output of U4271B will follow the Data input only after the clock pulse input has gone high. Therefore, the VIRS Present signal will go high only when the chrominance occurs just between instants 6 and 18 (as with the VIR signal).

The 9 Line Keyout signal resets U4681A & B once each field, so that the VIRS Detector must examine each field for VIRS.

When the VIRS Present signal goes high, the VIRS INCOMING lamp is turned on.

VIRS Logic

The VIRS Logic circuit enables the VIRS luminance and chrominance circuits, and drives the VITS Key if VIRS is to be generated.

U4841A shuts off VIRS if burst is lost, or if a monochrome signal is received (except when P4779 is programmed for VIRS Insertion on Monochrome, see discussion of Diagram 10).

U4841D allows the Opposite Field VIRS Preview circuit to insert VIRS on the opposite field of that programmed for. This occurs only in the Preview mode, on the PREVIEW MONITOR OUT connector; and when P4550 has pins 1 & 2 connected. U4761B receives the VIRS line and field programming information from the matrix. Since the gate requires all inputs high, the VIRS field information will enable the gate during the opposite field from the programmed for. If VIRS is programmed to be inserted on both fields, this circuit cannot be enabled. VIRS must be present on the Program signal, and detected by the VIRS Detector circuit (VIRS Present signal high) to enable the gate.

U4841B receives a low when the Preview mode is selected, enabling the Opposite Field VIRS circuit.

The signal from U4571F pin 12 on Diagram 10, to U4551D is normally low, except when Remote VIRS Control circuitry is used (see the Operating Instructions).

The output of U4571D is the VIRS Enable signal. This signal drives the luminance and chrominance circuits that form the VIR signal.

NOISE Logic (147A only)

This circuit enables the VITS Key circuit to insert the NOISE VITS and, when the correct conditions are set, insert NOISE during 1/2 line on the entire active field.

U4641C is driven by the Vertical Blanking signal, and by a signal which is low when the PREVIEW mode of operation is selected.

U4641B is driven by the output of U4641C and by a NOISE gate signal. The NOISE gate signal is normally low during the NOISE VITS time. When the NOISE switch is set to INSERTION (HALF LINE), the NOISE gate is low only between instants 12 and 24 of the NOISE VITS time, allowing only 1/2 line of the NOISE signal to be inserted on the VITS line. If, in addition, the FULL FIELD SIG Selector switch is set to NOISE, the NOISE gate is low for 1/2 line during NOISE VITS and for 1/2 line of each line in the active field.

Therefore, when the PREVIEW mode, with the NOISE test signal selected, and the NOISE switch set the INSERTION (HALF LINE), the NOISE gate will enable the VITS Key circuit to insert the NOISE signal during the center half of each full field line on the PREVIEW MONITOR OUTPUT. This allows comparison of noise on the Program signal with the internally-generated noise (see Operating Instructions).

COLOR TEST SIGNAL Logic (149A only)

This circuit enables the VITS Key circuit during the COLOR TEST SIGNAL VITS time.

U4641B combines the inverted Vertical Blanking signal and the COLOR TEST SIGNAL VITS line and field information. This signal drives the VITS Key circuit.

NOTE

Pin 10 of U4641C is not used by the 149A, so is pulled from the socket to avoid an unwanted condition.

FULL FIELD LOGIC DIAGRAM 10

The circuits on Diagram 10 include Test Signal Enables, VIRS Logic, and Indicator Logic.

Test Signal Enables

VIRS Detector Enable. U4741D combines the VIRS line and field information with Horizontal Blanking to provide a positive-going pulse during the time that VIRS is programmed for.

FIELD SQUARE WAVE Enable. When the FULL FIELD SIG Selector switch is set to FIELD SQUARE WAVE, Horizontal Blanking is gated through U4841C and U4781A. The output signal is a positive-going Horizontal Blanking signal that only occurs when the FIELD SQUARE WAVE signal is selected.

COMPOSITE Enable. When the COMPOSITE signal is selected, Modified Vertical Blanking is gated through U4171D. VITS timing is added by U4171C, giving a field rate signal with VITS time that is low when the COMPOSITE signal is to be generated.

FLAT FIELD Enable. Modified Vertical Blanking is gated through U4171A when the FLAT FIELD signal is selected, or when the signal from the ALT APL circuit on Diagram 9 is low. The output signal is high when the FLAT FIELD signal is to be generated.

COLOR TEST SIGNAL Enable - Narrow H (149A). When the COLOR TEST SIGNAL is selected, Modified Vertical Blanking is gated through U4551B. VITS timing is added by U4551A. VITS H Blanking, a narrow H pulse, is added by U4151D. The output signal is low when the COLOR TEST SIGNAL is to be generated.

NOISE Enable (147A). When the NOISE test signal is selected, Modified Vertical Blanking is gated through U4551B, and VITS timing is added by U4551A. U4151B and U4641A feed the VITS timing to the NOISE logic and VITS Key circuit on Diagram 9. When the NOISE switch is set to INSERTION (HALF LINE), U4151B is disabled. VITS timing is gated by H Blanking through U4151C and U4551C. U4151A gates this signal through between instants 12 and 24 only. That signal is fed to the VITS Key circuit on Diagram 9. U4571E provides the NOISE Enable signal that is low when NOISE is to be generated.

NOISE Pedestal Enable (147A). U4151C combines the H Blanking signal and the NOISE VITS timing to produce a signal that is low when the NOISE signal is to be generated.

COLOR TEST SIGNAL Enable - normal H (149A). U4151C combines the VITS timing and H Blanking to provide a signal that is low when the COLOR TEST SIGNAL is to be generated. The width of this signal determines the width of the generated signals.

WINDOW Enable and P & B Enable. When the WINDOW signal is selected, the Modified Window signal is gated through U4861C. Modified Vertical Blanking is gated through U4881D, forming the P & B Enable signal. The two signals are added by U4861A. The output signal, WINDOW Enable, is high between lines 66 and 218, and drives the BAR timing circuit. The P & B Enable is high for the WINDOW signal.

When the SIN^2 PULSE & BAR signal is selected, the P & B Enable is formed the same as for WINDOW. U4861C is disabled, allowing the WINDOW Enable to be similar to the P & B Enable. The Bar portion of the signal will occur on all the same lines as the Pulses.

MULTIBURST Enable. When the MULTIBURST signal is selected, Modified Vertical Blanking is gated through U4881C. VITS timing is added by U4861B. The output signal is high for the MULTIBURST signal to be generated.

LINEARITY Enable. When the LINEARITY signal is selected, Modified Vertical Blanking is gated through U4881B. If the LINEARITY signal is chosen for a VIT Signal, the VITS timing will be added by U4781F. The output signal is high for the LINEARITY signal to be generated.

VIRS Logic

As factory-wired, pins 12 and 24 of P9014 (the REMOTE plug) are connected, and pins 22 and 23 are open. When VIRS is detected on the Program signal, U4761C is disabled, allowing the incoming VIRS to pass undeleted. If VIRS is not detected, and the Program signal is in color, U4761C will be enabled. If the Program signal is in monochrome, the Burst Unlock signal will be low, disabling U4761C. VIRS may be inserted on a monochrome Program signal by placing the jumper on P4779 to connect pins 1 and 2.

The Program Sync and Burst Regeneration jumper on P4780 is normally connected to pins 1 and 2. In this position, the Relay Mode signal from Diagram 1 is fed to U4661C in the VITS Key circuit on Diagram 9. Sync and burst will not be inserted on any Program signal in this mode.

When P4780 pins 2 and 3 are connected, the Burst Unlock signal from Diagram 20 feeds the VITS Key circuit. In this position, sync and burst are inserted on a color Program signal, but monochrome signals are not affected.

When P4780 pins 3 and 4 are connected, the Burst Unlock signal is inverted and fed to the Modulator to shut off the burst when a monochrome signal is received. In this position, sync and burst are inserted on a color signal, and sync is inserted on a monochrome signal.

Indicator Logic

This circuit determines which indicator lamps will be lit. Q4180, Q4190 and Q4280 are controlled by the VIRS logic circuits. Q4480, Q4490, Q4390, and Q4380 are controlled by the Program Control circuits.

GEN-LOCK CIRCUITRY DIAGRAMS 11 12 & 13

The Gen-Lock circuitry is used to provide reprocessed composite sync and lock the internal 3.58 MHz oscillator to the incoming burst signal.

Sync Strip & Chroma AGC Amp 11

Sync Separator Circuit

The Sync Separator circuit removes sync from the externally applied composite video signal. Processing of the composite sync eliminates any degradation of the incoming composite sync, such as white noise, 60 Hz hum, etc.

Processing of composite sync is accomplished by clamping the sync tip level of the external composite video to a predetermined level, then adjusting the blanking level by controlling the overall circuit gain.

Fig. 4-5 is a block diagram of the Sync Separator circuit, and the description that follows is organized with respect to the Block Diagram and Diagram 11.

The sync tip of the external video signal (applied to the PROGRAM LINE IN or BLACK BURST IN connectors) is clamped at the sync tip level by the Sync Tip Comparator circuit, consisting of voltage comparator Q5371 and CR5380, operating as a current switch. The comparator is rate-limited and uses the dc-coupled sync to activate it. Once the comparator is switched, any tilt from the field or the line rate sync tips is eliminated. The rate limiting allows the feedback loop (through Q5481 and Q5291) to open at the trailing edge of the sync pulse, and mades the loop unresponsive to impulse noises. It also allows the Level Memory (C5291) to average the white noise on the sync tip during the time the loop is closed. This average determines the sync tip level.

The output from the Level Memory is applied to two filters. The high frequency errors (sync tip tilt) pass through the High Pass Filter, (R5070-C5065) to control the Summing Amplifier (Q5281). The low frequency com-

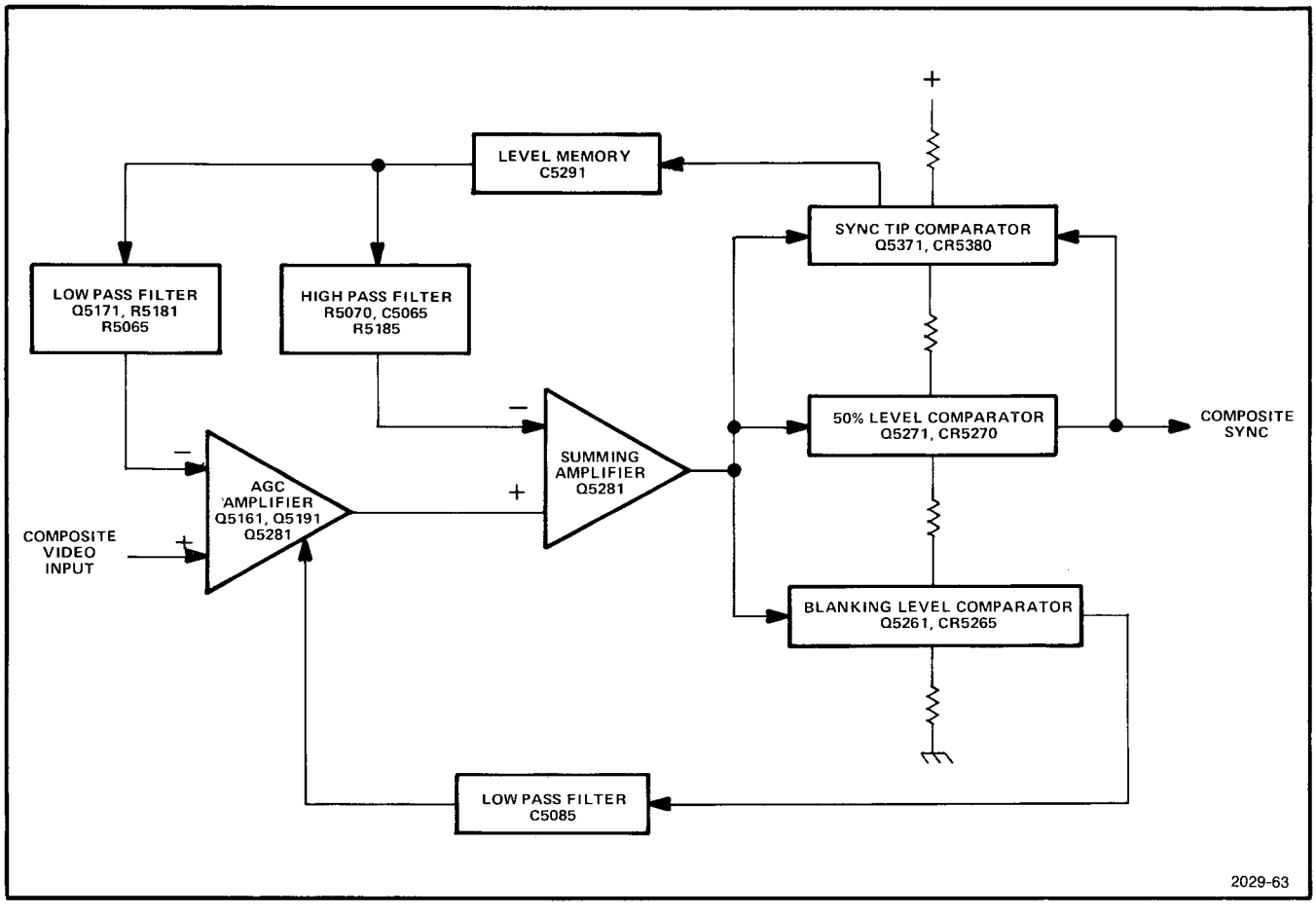


Fig. 4-5. Block diagram of Sync Separator circuit.

ponents are fed back via the Low Pass Filter (Q5171) to drive the AGC Amplifier (Q5161, Q5191, and Q5281). This filtering eliminates most 60 Hz interference.

The 50% Level Comparator (Q5271-CR5270) processes the sync at the 50% amplitude point between the sync tip level and the blanking level, ensuring correct sync width.

The Blanking Level Comparator (Q5261-CR5265) uses the difference in the duty factor between the sync pulse width and blanking width to determine the blanking level. This method allows the entire system to function because timing information is not required to close the AGC loop. The Low Pass Filter (C5085) averages the output of the Blanking Level Comparator; this voltage controls the overall system gain through Q5191.

Back Porch Gate Generator

The Back Porch Gate Generator consists of Q5251 and Q5151. It provides gate pulses to the demodulators which correspond to the time of line sync and back porch, or the time of back porch only.

Negative-going composite sync pulses are applied to CR5260 via the Sync Separator circuit. CR5260 reverse-biases on the leading edge of the composite sync and C5258 charges towards −15 V through R5162. The charge path for C5258 is via Q5251 (normally on) and R5162. The trailing edge of the composite sync forward-biases CR5260, which couples a positive pulse through C5258 and turns Q5251 off, producing a series of negative-going pulses at the collector of Q5251. These pulses are coincident with the trailing edge of the line sync, the equalizing pulses, and the vertical sync pulses.

With P5141 in the BURST position (pins 1 and 2 connected), composite sync pulses via R5260 are added to the delayed pulses from Q5251, to drive Q5151. The duration of each output (positive-going) pulse to the demodulators corresponds to the duration of the input line sync and back porch. With the BURST-CW jumper wire (P5141) in the CW position (pins 2 and 3), the output pulse duration to the demodulators corresponds to the time of back porch only.

AGC Subcarrier Amplifier

The AGC Subcarrier Amplifier consists of the Chroma Trap (C5050 and L5055) and three operational amplifiers in series with external AGC control.

Chroma Pickoff. The trap consists of a series resonant LC circuit (C5050 and L5055). The 3.58 MHz components of the signal, applied to the input, are separated from the external sync by the trap and applied to the Chroma Buffer Amplifier.

Chroma Buffer Amplifier. Q5051 and Q5041 are connected as an operational amplifier with low input impedance. The output (3.58 MHz subcarrier signal current) is regulated by the AGC circuit and applied to a second operational amplifier, Q5031-Q5021.

AGC Operation. The Gain Control circuit components include Q5141 and CR5035. This circuit regulates the subcarrier signal current (through CR5030 to the input of operational amplifier Q5031-Q5021) by shunting a portion of the signal current (at the junction of C5042 and C5040) through CR5035 to ground. The amount of current shunted through CR5035 depends on the current demand of Q5141. If the subcarrier signal current is excessive, an increased negative-going corrective signal from the AGC Comparator is applied to the base of Q5141. This increases the current through Q5141, which increases the current through CR5035. This decreases the impedance across the diode and shunts more of the signal current away from operational amplifier Q5031-Q5021, thereby decreasing the gain of the amplifier stage.

Limiting Amplifier. Q5031 and Q5021 are connected as a low input impedance operational amplifier with the feedback resistance (R5022) shunted by CR5010, CR5015, and C5022. This provides signal limiting to ensure that the subcarrier (due to peak signals) does not leak through the demodulator during non-demodulation time.

Output Amplifier. The output amplifier (Q5131-Q5231), an operational amplifier, ensures adequate drive current for the demodulators. L5101 is adjusted to compensate for subcarrier phase-shift errors through the amplifiers.

Quadrature Demodulators 

The Quadrature Demodulator circuits produce output signals which correspond to the amplitude and phase of burst (if any) from the externally-applied composite video signal, to control the internal master oscillator.

Quad Phase and Limiting Drivers. Q5511, Q5521, Q5331, and Q5431 are connected as differential comparators. Q5511 and Q5331 are turned on and off, at the subcarrier rate, during line sync and back porch time (or back porch only) to provide switching current to the demodulators. Q5521 and Q5431 are driven by the internally-generated subcarrier signal, with Q5521 operating 90° later than Q5431. Subcarrier delay is provided by L5601, C5615, and C5620. R5610 terminates the line. Quadrature shift allows burst demodulation in any quadrant (demodulation may take place between 0 and 360 degrees). Q5511 and Q5331 are driven simultaneously by the Back Porch Generator. (See Sync Separator and Chroma AGC Amp description.)

Quad Demodulators. The demodulators, Q5241 and Q5311, are forward biased by Q5511 and Q5331 during non-demodulation time. External chrominance from the Chroma AGC Amp is therefore shunted to ground through Q5241 and Q5311. During demodulation time (burst time of the external chrominance signal), Q5241 and Q5311 are switched by the demodulator enable switch at the subcarrier rate. The demodulated chrominance signal is then applied to low-pass filters L5242, C5242, L5320, and C5335. The output of the filters is therefore, a dc level that represents the phase and amplitude of the external burst signal plus the internal subcarrier signal. Under normal operating conditions, the output of Q5241 is 0 volts; the output of Q5311 is a negative dc voltage level during burst time. The output of each demodulator filter drives the AC Pulse Amplifier.

AC Pulse Amplifiers. Q5351, Q5451, Q5341, and Q5441 amplify the demodulated chrominance signal level obtained from the filters and drive memory capacitors C5540 and C5450.

Reference Clamps. Q5551 and Q5471 hold the inputs to the Quad Phase Burst Rectifiers and Buffer Amplifiers at 0 volt during non-demodulation time. This allows the memory capacitors to charge to a dc level dependent upon the phase and amplitude of the demodulated signal.

During back porch time, a signal applied from the Back Porch Gate Generator turns Q5471 and Q5551 off. This permits the charge on the memory capacitors to drive the Quad Phase Burst Rectifiers and Buffer Amplifiers.

Buffer Amplifiers. Emitter followers Q5561 and Q5571 provide sufficient current to drive the DC Error Amplifier, Quad Lock Detector, and Rectifier circuits. The Buffer Amplifiers also isolate the input to the Quad Phase Burst Rectifier.

Quad Phase Burst Rectifiers. Q5461 and Q5661 are the active components of this stage, and are connected as phase inverters. This allows detection of the demodulated signal in any quadrant.

During back porch time the charge, if any, on memory capacitors C5540 and C5450 drives Q5461 or Q5661 to produce a positive or negative (depending on phase) output. The more negative pulse is then coupled through one of the diodes CR5570, CR5572, CR5676, or CR5674 to drive the Burst Tip Detector Q5581.

Burst Tip Detector. Q5581, an inverting amplifier, drives the DC Restorer Clamps during burst tip time. C5570 holds the level of the last negative pulse applied from the Quad Phase Burst Rectifier stage. This sets the bias of Q5581 near conduction, reducing the time to turn on DC Restorer Clamps Q5591 and Q5681.

DC Restorer Clamps. Q5591 and Q5681 restore the dc level of the demodulated chrominance signal (Phase Control and Quad Signals) from the Buffer Amplifiers during burst tip time. When the Burst Tip Detector turns on, both Q5591 and Q5681 are turned on. This clamps the output of the Quad Demodulator stage (TP5690 and TP5580) at about 0 volt.

Burst Lock Disable. Q5491 is the active component of this stage and is used to turn on the DC Restorer Clamps except during Gen-Lock.

With the instrument operated in the non-gen lock mode (no incoming sync), Q5491 is turned on by a signal from the Sync Present Detector (see Diagram 20). This turns the DC Restorer Clamp transistors on, clamping the output of the Quad Demodulator stage at all times.

Subcarrier Oscillator and Frequency Control 13

The Subcarrier Oscillator and Frequency Control circuitry is used to switch the internal 3.58 MHZ Subcarrier Oscillator from a free-run mode to a locked mode or vice-versa.

500 Hz Filter. R5790-C5788 and R5798-C5799 filter the signal pulses from the Quad Demodulators to provide a signal that corresponds to the amplitude and phase of the external burst.

Quad Phase Rectifier. To provide lockup independent of external burst phase-errors versus internal subcarrier phase at the moment of Gen-Lock attempt, Q5791-Q5871 and Q5881-Q5891 are connected as paraphase amplifiers. The output of each amplifier is applied to a peak detector.

Peak Detector. The peak detector circuit consists of CR5878, CR5877, CR5887, and CR5885. The most negative dc level from the Quad Phase Rectifier circuit is detected and applied to the dc Buffer Amplifier.

DC Buffer Amplifier. Emitter follower Q5981 acts as a buffer and provides the necessary drive for the AGC Comparator and Burst Present Detector circuits. The output of the buffer is filtered by R5877 and C5775 to

ensure an average dc level control voltage to the above circuits. The filter has an approximate bandpass of 5 Hz, which causes noise that appears at this point to be common mode to both sides of comparator Q5781-Q5771.

AGC Comparator. Q5781 and Q5771 are connected as a differential comparator with the base of Q5771 reference to a fixed dc level. The AGC Comparator is biased by the output level of Q5981 so that Q5771 is switched off, thus no AGC current is available to the AGC amplifier. With Gen-Lock, the output from the peak detector drives the AGC Comparator so that an AGC current, corresponding to the amplitude of the externally applied burst signal, is developed through Q5771. This current is fed back to the Chroma AGC Amplifier and increases or decreases the overall chroma gain. Under normal Gen-Lock operation, burst amplitude of 10 to 40 IRE units switch the comparator and produce an AGC output current.

Burst Present Detector. Q5591 and Q5971 are connected as a Schmitt Trigger circuit. If external burst is present, the output dc level from the buffer (Q5981) steps down and triggers the Schmitt circuit. The differential output of the Schmitt circuit drives the Subcarrier Reference Switch.

Subcarrier Reference Switch. Q5951 and Q5931 form this circuit, which is controlled by the Burst Present Detector. When not Gen-Locked, both transistors are saturated. This provides a resistive divider consisting of R5920, R5929 (3.58 MHz adj.), and R5910 connected between −15 volts and ground (through both transistors). Control of the internal oscillator frequency depends on the setting of R5929. When Q5951 and Q5931 are reverse-biased by the output of the Burst Present Detector, the Subcarrier Reference Switch circuit "floats". Control of the internal master oscillator now depends on the Quad Demodulators output signals that are applied to the Error Amplifier Q5941-Q5961.

Error Amplifier and Band Switch. This circuit controls the internal oscillator frequency during Gen-Lock mode of operation. Q5961 and Q5941 are connected as an integrating operational amplifier with C5862 as the feedback capacitor. R_i for this amplifier consists of R5770 or R5770 shunted by R5772, and Band Switch Q5761.

The rate of integration of the operational amplifier is changed by switching the Band Switch (Q5761) on or off. The input resistance (R_i) is low when Q5761 is switched on. This increases the rate and amount that the amplifier output voltage shifts the internal master oscillator. With Q5761 turned off, the rate is relatively slow (R_i high) and the bandwidth shift of the oscillator is narrow, improving the noise immunity of the amplifier. Control of Q5761 is obtained from the Quad Lock Detector circuit.

Quad Lock Detector. The Quad Lock Detector circuit consists of a lock delay circuit (Q5861) and a Schmitt multivibrator circuit (Q5841-Q5831). The output of the multivibrator controls the Band Switch.

During initial Gen-Lock, Q5861 is forward-biased by a negative pulse applied via CR5865 from the Burst Present Detector circuit. This discharges C5850, which turns Q5841 on. The output of the detector (collector circuit of Q5831) is therefore a negative gate which switches Q5761 on. When lock occurs, Q5861 is turned off by the quadrature signal from the Demodulator circuit, allowing C5850 to charge towards +15 volts. This delays triggering the Schmitt multivibrator to turn Q5761 off, which ensures lock has occurred.

Q5851 is part of the Reed Switch Drive circuit as described with diagram 20.

3.58 MHz Oscillator

The 3.58 MHz crystal controlled oscillator generates the subcarrier used by the instrument. In the free-running mode, the frequency will be within 25 Hz of 3.579545 MHz. In the locked mode, the frequency will be locked to the incoming program burst. The output is amplitude limited and applied to the Subcarrier Output Amplifier (see discussion of Diagram 20) for further processing.

FUNCTION GENERATOR DIAGRAM ◇14◇

The Function Generator generates triangular waves (for the burst packets of the Multiburst signal) and the 12.5T pulse.

MB Switching

When Multiburst is to be generated, the MB Enable signal will be high. Q6103 receives this high-state signal, and is saturated. The emitter of Q6010 goes low, reverse-biasing all of the diodes driven by the cathode of CR6017.

Multiburst Rate Control

This stage sets the rate of charge and discharge of the integrator in the Triangle Generator circuit.

The currents through the emitter circuits of the rate control transistors are converted into a voltage across the collector load, essentially R6144. The current through Q6106 sets the 500 kHz rate, and is summed with the currents from the other transistors in the circuit to control

the remaining Multiburst packets frequencies. Burst timing signals (from Diagram 6) enable each of the remaining transistors only for the time required for the corresponding burst packet. For example, Q6222 receives 2.0 MHz burst timing information from P2790-6 on Diagram 6. The timing signal goes low between Instants 18 and 21, turning off CR6022, and allowing the current developed in the emitter resistors to flow through Q6222 for that period of time.

Current Switch and Inverter

This stage provides charging and discharging current for the integrator in the Triangle Generator. The Current Switch is controlled by the Triangle Level Detector.

The voltage signal produced by the Multiburst Rate Control circuit is fed through emitter follower Q6262 to the bases of Q6266 and Q6164. There, the voltage signal is converted into a current signal. The emitter circuits of Q6266 and Q6164 are such that, for any given base voltage, Q6164 will demand twice the current at Q6266. The current in the emitter circuits depends on the voltage at the bases.

Current demanded by Q6266 is provided by U6170A. U6170B and U6170C form a constant-current generator providing the same current flow as in U6170A, except of opposite polarity. The entire circuit of U6170A, B, and C is called a "current mirror".

Q6162 and Q6068 are a current-switch circuit providing current for Q6164. When Q6068 is conducting, the Triangle Generator is driven by the collector of U6170C. When Q6068 is cut off, Q6162 turns on, connecting Q6164 to U6170C. Because Q6164 requires twice the amount of current available from U6170B and C, an equal amount of current is drawn from the Triangle Generator and the negative-going ramp of the triangular wave is generated.

Triangle Generator

This stage is basically an integrating operational amplifier, providing linear positive- and negative-going ramps. The charging and discharging currents driving the integrator determine the ramp rate.

The Triangle Generator consists of Q6398, Q6494, and C6382. Q6482 is held in a clamped or conducting condition when no signal is desired from the Triangle Generator. When a triangle signal is desired, CR6376 is reverse-biased and Q6482 is cut off. At this time, the frequency determining current described above is allowed to flow in C6382, the negative feedback component of the integrator. Q6398 and Q6494 provide the necessary voltage ramp at the opposite end of C6382 to satisfy the formula for current flow in a capacitor:

$$i = C\frac{dv}{dt}.$$

A positive ramp is generated when the input current is only from U6170C. A negative ramp is generated when current through Q6162 is added to the circuit.

The remaining components in the Triangle Generator form an emitter follower. Q6478 and Q6496 are current sources, Q6593 is the emitter follower. The output level of Q6593 is essentially the same as the voltage on the collector of Q6494 because of the junction drop across CR6588.

At +5 volts ramp amplitude, the Triange Level Detector switches the Current Switch, causing Q6162 to be switched into the circuit, reversing the polarity of the integrator input current, and changing the direction of the ramp. The direction of input current will be changed again when the ramp reaches −5 volts.

Ramp rate is determined by the magnitude of input current. As current in both directions is of the same magnitude, the ramp rates (positive and negative) are the same, resulting in symmetrical triangle waveforms of a particular frequency.

The Triangle Generator is shut off when it is not required to generate triangles. The Stop Control circuit pulls down on the cathode of CR6376 when the generator reaches the bottom of the last desired cycle. The voltage at the cathode is set by the Stop Level circuit (−1.2 volts for Multiburst, and −6.1 volts for Modulated Pulse). When the positive-going ramp at the emitter of Q6482 reaches a level high enough to forward bias CR6376 and Q6482, the transistor conducts. This creates a current path around C6382, shutting off the Triangle Generator.

Triangle Level Detector

When the output of the Triangle Generator reaches about +5 volts, Q6786 is forward biased enough to cause tunnel diode CR6182 to switch to its low state, about −50 mV. This turns off Q6068.

When the output of the Triangle Generator reaches about −5 volts, Q6877 is biased on. This causes CR6182 to switch to its high state, about −500 mV, turning on Q6068.

Stop Control

This stage enables the Triangle Generator during the time when Multiburst packets or the Modulated Pulse are to be generated. A positive-going pulse of the necessary width is applied to the emitter of Q6198 from the Mod Pulse Timing circuit on Diagram 6. This signal causes a positive-going voltage to appear across R6395, turning Q6298 on and Q6392 off. This allows CR6376 to reverse bias, turning off Q6482. At that time the Triangle Generator starts to run.

Q6095 and Q6198 form a "Wired OR" circuit. When the pulse at the emitter of Q6198 goes low, that transistor is cut off. The emitter of Q6095 will remain high until the end of the last negative-going ramp. The tunnel diode, CR6182, controls the switching pair, Q6192 and Q6091. The base of Q6091 is set at about 200 mV. When CR6182 is in its high state, Q6192 is on and Q6091 is off. This leaves the base of Q6095 pulled negative. When CR6182 is in its low state, Q6192 is off and Q6091 is on. This pulls up on the base and emitter of Q6095.

Stop Level

The Stop Level circuit sets the level at which the Triangle Generator will stop when shut off by the Stop Control circuit.

When the Multiburst signal is selected, the MB Enable at P6951-6 is high. This forward biases CR6966 and Q6772, turning off Q6672. The voltage at the base of Q6569 is then set to about 0 volt by the resistor network consisting of R6677, R6673 (MB Centering), and R6689. When Q6392 in the Stop Control circuit is forward biased, the level at its collector is set at two junction drops lower than the base of Q6569. The emitter of Q6482 is up two junction drops, so when the level at the emitter reaches about 0 volt, Q6482 conducts, shutting off the Triangle Generator. CR6588 raises the level one junction drop, and Q6593 lowers the level one junction drop. Therefore the quiescent level of the output at the emitter of Q6593 will be very nearly the same as that set at the base of Q6569. This quiescent level will be the center level or pedestal of the Multiburst signal.

When the Multiburst signal is not selected, the MB Enable is low. This reverse biases CR6966 and Q6772, turning on Q6672, and turning off Q6569 and CR6469. With Q6392 on, its collector voltage is set by the resistor network at the base of Q6452. The level at the base is about −5 volts. As before, this level then appears at the emitter of Q6593 when the Triangle Generator is shut off.

NOISE & MULTIBURST PEDESTALS DIAGRAM 15

This diagram includes the shaping filter and amplifier for the output of the Function Generator, and current sources for determining luminance amplitudes for: Multiburst Pedestal, Multiburst Center Level, Pulse & Bar Setup, and Noise Pedestals (147A only).

Diode Shaper

The Diode Shaper circuit converts the triangular output from the Function Generator into sinewaves. The shaper consists of a diode and resistor network, forming a diode ladder filter. Q6624A & B are the current sources for the ladder filter. CR6624 and CR6634 provide temperature compensation for the current sources. The emitter of Q6624A sits at about +2.8 V, and the emitter of Q6624B sits at about −2.7 V. The resistors in the ladder filter determine the level at which the diodes will conduct. As the output of the Triangle Generator increases or decreases, individual diodes turn on and off. The transitions as the diodes conduct are smoothed out by the capacitance of the diodes. The capacitance increases as the diodes approach conduction. The resultant of the filter is a close approximation of a sinewave.

Shaper Amplifier

The Shaper Amplifier is an operational amplifier consisting of transistors Q6653B, Q6758, and Q6852. Temperature compensation for the amplifier transistors is provided by Q6653A and Q6858. R_i is essentially R6648. R_f is basically R6741 (MB Gain) and R6844. R6736 and C6844 provide frequency compensation. The dc level of the output signal is set by R6942 (MB Sync Level).

Multiburst Pedestal

This circuit sets the pedestal amplitudes of the MULTIBURST signal. Q6813, Q6824, and Q6828 are current sources for the Luminance Amplifier. These transistors are controlled by the switching diodes on their emitters.

When the MULTIBURST signal is selected, the MB Pedestal Enable goes low, turning off diodes CR6913, CR6918, and CR6923. Q6828 is then enabled between Timing Instants 5 and 31 when the H Blanking signal goes low, turning off CR6925.

Q6813 is enabled between Instants 5 and 8 by the MB 100 IRE Enable. The current through Q6813 sums with the current from Q6828 to form the 100 IRE MB White Reference Pedestal.

Q6824 is enabled between Instants 8 and 31 by the MB Burst Pedestal enable. This current sums with the current from Q6828 to form the MB Center Level. The center level amplitude is controlled by MULTIBURST AMPLITUDE switch S9250. In the NORMAL (147A) or FULL (149A) position, R6910 is in parallel with the series combination of R6920 and R6836 (MB Center Level). This produces a 55 IRE pedestal. In the REDUCED (147A) or 60 IRE (149A) position, the switch end of R6910 is grounded. The opposite end of R6910 is also at about 0 volt; therefore, no current will be drawn through this resistor, and the current through Q6824 will decrease. This results in a 40 IRE pedestal amplitude.

PULSE & BAR Setup

This circuit allows a 10 IRE setup level to be added to the PULSE & BAR signal when desired. When the jumper on P6722 is connected between pins 1 and 2, CR6709 is turned on, keeping Q6803 turned off. When setup is desired, the jumper is moved to pins 2 and 3. This turns off CR6709 and allows Q6803 to be controlled by the Setup Timing enable. If the SIN^2 PULSE & BAR signal is selected, Q6803 will be on between Instants 5 and 31. If the COMPOSITE signal is selected, Q6803 will be on between Instants 16 and 31. This allows the P & B portion of the signal to be offset, but not the LINEARITY portion.

NOISE Pedestal (147A)

Q6715 is the current-source transistor for the NOISE PEDESTAL circuit. When the Noise Pedestal Timing goes low, CR6603 turns off, enabling Q6715.

With NOISE switch S9225 in the DELETE position, the switch end of R6706 is grounded. In the 10 IRE position of PEDESTAL switch S9230, current flow through Q6715 is determined by R6728 and R6734. In the 50 IRE position, R9230 is connected in parallel with R6734, increasing the current flow. In the 100 IRE position, current flows only through R6728.

When NOISE switch S9925 is in the INSERT position, R6706, R9223, and R9225 (VAR) are connected into the circuit. This network provides a variable offset of about ±10 IRE for each of the pedestals selected by S9230.

FILTERS AND OUTPUT AMPLIFIERS DIAGRAMS 16 and 17

This board contains the two major output amplifiers for the instrument. One amplifier handles luminance signals; the other handles the chrominance, noise, and the burst packets of the multiburst signal. This board also contains the External VITS Amplifier and a clamp circuit, which ensures that the black level of inserted VITS matches that of the incoming program signal. The sine-squared pulse and bar generators, together with the sine-squared shaping filters, are also included on this board.

Diagram 16

Pulse Generator

The T or 2T sine-squared pulse is generated by driving a sine-squared shaping filter with a very narrow pulse. When a 2T or T pulse is desired, a negative-going pulse is inverted in L7110 and applied to the base of Q7001. This turns on Q7001 and discharges C7212 through Q7221. The amplitude of this pulse is determined by the value of the voltage to which C7212 was charged prior to its discharge time. This in turn is determined by either R7138 (T pulse) or R7131 (2T pulse). The resulting pulse of current in the collector of Q7221 is applied to either the T or 2T Filters.

Bar Amplitude

Negative-going bar-width pulses allow emitter current to flow in Q7241, which is adjustable by R7143. The resulting current is applied to either the T or 2T filter. Selection of T or 2T risetimes or pulse widths for the bar and pulse is made by placing the jumpers on P7321 as described in the operating instructions. Q7531 biases Q7241 and provides thermal compensation.

Mod Pulse Amplifier and Switch

The modulated sine-squared pulse is composed of the linear addition of a 12.5T (or 20T) luminance pulse and a like chrominance pulse envelope. The luminance portion of this signal is processed by this stage.

The Mod Pulse Switching signal is high when a test signal containing the Modulated Pulse is selected. The emitter of Q7251 goes low, supplying the Mod Pulse Current Timing and the Mod Pulse Modulator Enable to Diagram 18 of the 149A or Diagram 19 of the 147A. CR7345 and CR7341 are pulled high, turning off Q7443. Q7630 conducts, and allows the Function Generator output current to pass. The output of Q7630 is fed to the Luminance Amplifier through the Delay circuit.

When the Modulated Pulse is not part of the selected test signal, Q7443 conducts, supplying a constant current to the Luminance Amplifier, and Q7630 is turned off, inhibiting the Multiburst signal from affecting the Luminance Amplifier.

Delay

The Delay circuit is used to produce a delay equal to the delay of the Modulator and its associated Bandpass Filter, so that both the chrominance and the luminance portions of the Modulated Pulse get the same amount of delay. Thus, the resulting composite pulse exhibits no chrominance-to-luminance delay.

Filters

The T and 2T sine-squared shaping filters are used to produce sine-squared transitions from the very fast Pulse or Bar Generator[1]. Several other inputs are also provided to the T and 2T Filters. These include all the various pedestal signals, and all the various flat field signals. The luminance portion of the staircase and full line linearity signals are also applied to the 2T Filters. These various inputs appear on P7101 and pins 3 and 4 of P7001.

Diagram 17

Luminance Amplifier

The Luminance Amplifier consisting of Q7711, Q7811, Q7911, and Q7921, receives signals from the outputs of each of the three filters mentioned previously. The amplifier is an operational amplifier whose gain is set by R7735. Its output impedance is low enough to drive three 75 ohm loads. These are the front and rear full field test signal jacks and the termination provided by the External VITS Amplifier.

Chrominance Amplifier

This amplifier is very similar to the Luminance Amplifier; however, associated with its input circuitry are several auxiliary circuits. The chrominance enters this amplifier at pin 2 of P7691 and may be adjusted in amplitude with R7661. The noise signal for the 147A enters at pin 6 of P7691. The flow of noise is controlled by two noise gating transistors, Q7551 and Q7651. The level of the noise may be adjusted with R7561.

Multiburst Amplitude

This stage sets the amplitude of the Multiburst signal, either 90 IRE or 60 IRE, and is front-panel controlled. The output is then applied to the Chrominance Amplifier.

Multiburst enters at pin 1 of P7491 (see Diagram 16). Signal current flows at all times through R7551 and R7553. This allows 60 IRE amplitude to be produced. When the 90 IRE amplitude is desired, Q7481 is turned off by the MULTIBURST AMPLITUDE switch, and signal current then flows through two parallel paths, R7551-R7553 and R7461-R7581. Both Q7481 and Q7571 are turned on when the multiburst signal is not to be generated.

Ext VITS Amplifier

An external VIT signal may be inserted on the program output of the 147A or 149A. Such a test signal is applied to Ext VITS In connector J9011 on the rear-panel. This signal is amplified by Q7981, Q7971, and Q7961. The output of this amplifier is connected to the VIT Signal input of both the Program and Preview VIT Signal switches.

VITS Level Corrector

Since the incoming program signal is clamped to ground, as described in Diagram 1, the internal VIT Signals are also clamped to ground so that, when they are inserted, the two black or ground levels match.

A sampling pulse is supplied to pin 1 of P7003 during the back porch portion of the internally-generated test signals. Q7191 is turned on by this clamp pulse, and the resulting sampled level is transferred to memory capacitor C7383. This voltage is amplified by high-gain operational amplifier U7291. This amplifier error signal is further amplified in the Ext VITS Amplifier, and applied once again to the same point as originally sampled. This restores the back porch level of the VIT Signals to ground.

MODULATOR DIAGRAM 18 (147A)

The circuits on Diagram 18 of the 147A are used to shape and combine the signals requiring modulation, and apply them to the modulator for mixing. In addition, the Composite Sync and VIRS Pedestal luminance currents are generated by circuits on this diagram.

Sync Amplitude

Inverted Composite Sync turns off Q8720 during sync time so that the luminance amplifier will be at its most negative level (−286 mV) at that time. At all other times, current flows through Q8720. R8730 (Sync Amplitude) is adjusted for 286 mV difference between the sync level and blanking level.

[1] **A. Kastelein "A NEW SINE-SQUARED PULSE AND BAR-SHAPING NETWORK" IEEE Transactions of Broadcasting, Volume BC-16, Number 4, DEC. 1970 (pp 84-89).**

VIRS Pedestal

This stage consists of a set of three current switches to generate the VIRS luminance pedestal.

The VIRS Enable signal goes low when VIRS is to be generated, allowing VIRS timing to operate the current switches. Currents from all three sources are added between Instants 6 and 18 to form the 70 IRE pedestal. Currents from Q8820 and Q8920 are summed between Instants 18 and 24 to form the 50 IRE pedestal. The 7.5 IRE pedestal is formed by the current from Q8820 between Instants 24 and 30.

VIRS Modulation Amplitude and Filter

This stage generates the VIRS modulation signal, and shapes the envelope.

VIRS Enable goes low when VIRS is to be generated, allowing Q8090 to be controlled by the VIRS subcarrier timing. The VIRS subcarrier timing allows current to flow through Q8090 between Instants 6 and 17.

The current from Q8090 is applied to the VIRS Filter to be shaped with a risetime of approximately 1 μs.

Burst Timing and Filter

This stage generates the burst timing pulse and the burst modulation current, and shapes the current before feeding the modulator.

The trailing edge of inverted Composite Sync passes through C8535 and turns off Q8540. C8535 charges through R8538 at a rate that turns on Q8540 after about 600 ns. The pulse formed at the collector of Q8540 is fed by Q8430 to Q8530 (via C8530). The trailing edge of the pulse turns off Q8530, and C8530 charges through R8632 until Q8530 turns on again. This occurs after about 2.2 μs. The resulting pulse at the collector of Q8530 corresponds to the desired burst timing. U8510 uses the 9 Line Keyout signal to gate out the burst timing pulses during the vertical sync time. The output of U8510 is the burst timing signal.

Current switch CR8620-Q8620 sets the amplitude of the burst. CR8621 goes high and shuts off Q8620 when a monochrome program signal is received and P4780 pins 3 and 4 (Diagram 10) are connected.

The output current is applied to the Burst Filter for shaping. The Linearity Subcarrier current is also fed to the Burst Filter. The filter gives a risetime of approximately 375 ns.

Mod Pulse Modulation

The Mod Pulse Modulation circuit feeds the modulated pulse signal to the Modulator. When a modulated pulse signal is selected, the Mod Pulse Enable signal is low, allowing Q8850A and B to operate. The Function Generator 12.5T pulse drives the base of Q8850B and the base of Q8955. The output of Q8850B provides the drive to the modulator driver. C8959, at the emitter of Q8955, averages the Function Generator output. This level is fed to the base circuit of Q8850A through emitter-follower Q8950. R8750 balances the output of Q8850A and B, resulting in minimum residual subcarrier caused by the Mod Pulse Modulation circuit. The collector of Q8850A is a level which balances the Modulator driver. P8860 (12.5T Phase Reversal) directs the outputs of Q8850A and B. In the normal position, the signal output from Q8850B is fed to the emitter of Q8860A, and the output of Q8850A goes to the emitter of Q8860B. When P8860 is turned 90°, the outputs of Q8850A and B are swapped, resulting in a 180° phase shift in the modulated pulse phase.

Modulator

The 147A uses a modulator integrated circuit, U8890, to mix the modulation signals and the subcarrier. This is a balanced modulator, so that with no signal input there will be no signal output.

Subcarrier from Diagram 19, with phase determined by the Field Variable Phase circuit or the Field Fixed Phase circuit, is fed to the + and − subcarrier inputs of U8890. This provides the signal to be modulated.

The modulating signals are fed to the + and − signal inputs through Q8860A and B. R8960 balances the inputs so that no residual subcarrier will be present on the output.

The gain at the output is determined by the value of the resistors at pins 2 and 3 of U8890. The output signal is developed across L8680, then fed to the Bandpass Filter to reduce harmonics.

MODULATOR
DIAGRAM 18 (149A)

The circuits on Diagram 18 of the 149A are used to shape and combine all of the signals requiring modulation, and apply them to the modulator for mixing.

VIRS Modulation Amplitude

Current switch CR8801-Q8703 sets the amplitude of the VIRS modulation current. The current is then applied to the VIRS Filter.

VIRS Filter

The filter shapes the VIRS modulation current, so that the modulation has a risetime of approximately 1 μs.

Burst Amplitude

Current switch CR8603-Q8605 sets the amplitude of the burst. The output current is applied to the −(B-Y) filter for shaping. (Risetime approximately 375 ns.) CR8604 goes high and shuts off Q8605 when a monochrome program signal is received and P4780 (Diagram 10) pins 3 and 4 are connected.

B-Y and R-Y Filters

The ±(B-Y) and ±(R-Y) Filters are identical (when stray capacitance of the cables and board layout are considered) and consist of an LC Pi network. Each filter limits the bandwidth of its drive signal to approximately 1.5 MHz, which prevents any B-Y or R-Y component from exceeding the 3.58 MHz modulating frequency. These filters are adjusted so that the phase shift through each filter is the same. The electrical characteristics of the filters must be identical, since the composite signal is formed after the filters. Separate handling of the + and − components is required to achieve carrier balance stability.

Mod Pulse Modulation

The Mod Pulse Modulation circuit feeds the modulated pulse signal to the Modulator Drive circuit. When a modulated pulse signal is selected, the Mod Pulse Modulation Enable signal is low, allowing Q8133A and B to operate. The Function Generator 12.5T pulse drives the base of Q8133A and the base of Q8003. The output of Q8133A provides the drive to the modulator driver. C8031, at the emitter of Q8003, averages the Function Generator output. This level is fed to the base circuit of Q8133B through emitter follower Q8035. R8007 balances the output of Q8133A and B, resulting in minimum residual subcarrier caused by the Mod Pulse Modulation circuit. The collector of Q8133B is a level which balances the modulator driver.

P8327 (20T Phase Reversal) directs the outputs of Q8133A and B. In the normal position, the signal output from Q8133A is fed to the −(B-Y) driver, and the output of Q8133B goes to the +(B-Y) driver. When P8327 is turned 90°, the outputs of Q8133A and B are swapped, resulting in a 180° phase shift in the modulated pulse phase.

Field Phase Switch

The Field Phase switch selects whether the subcarrier to the modulator will be fed through the Field Fixed Phase circuit or the Field Variable Phase circuit. When a full-field signal is selected which includes the modulated pulse, output of the Field Variable Phase circuit is allowed to feed the modulator during the portion of the line programmed. Q8857 turns on, shunting the output of the Field Fixed Phase circuit. For all other conditions, when the modulated pulse is not enabled, the output of the Field Variable Phase circuit will be shunted by Q8851, and the Field Fixed Phase circuit will provide the subcarrier to the modulator.

Field Variable Phase

This stage allows a control range of greater than 180° (360° when P8327 is used) on the modulation of the modulated pulse.

Constant current source Q8927 charges C8901, producing a linear ramp at the collector of Q8903 (which is off during the ramp) for an entire field. During the vertical interval, Q8903 is turned on, discharging C8901.

The ramp voltage is applied to the cathodes of variable capacitance diodes CR8931 and CR8957. The voltage on the anodes of the diodes is between 0 and −2.5 volts dc, determined by the setting of R8939 (20T Phase). As the ramp voltage increases, the capacitance of the diodes decreases. These diodes, in conjunction with L8953, L8951, and C8933, form two resonant filters. The phase of the subcarrier going through these filters is determined by the voltage on the variable capacitance diodes. With a ramp on the cathodes of the diodes, the subcarrier phase will change throughout the field. If P8900 pins 2 and 3 are connected, +5 volts will be applied to Q8903, turning it on, discharging C8901, and keeping a ramp from being formed in this mode. The phase of the modulated pulse is determined by the setting of R8939 (20T Phase).

The output subcarrier is applied to an ac-coupled limiter circuit in the AGC circuit. After the limiter, the Field Phase Switch will either pass the subcarrier on to the AGC circuit, or shunt it to ground.

Field Fixed Phase

This stage adjusts the phase of the subcarrier of all chrominance signals except the modulated pulse. Front-panel INSERT SUBCARRIER PHASE control R9210 sets the amount of reverse bias on variable capacitance diode CR8789, which in turn sets the phase of the subcarrier going through R8785 and R8793. The output of the circuit goes to a limiting amplifier in the AGC circuit, where either the Field Variable Phase or the Field Fixed Phase is selected for feeding the modulator.

AGC Amplifier

The AGC Amplifier ensures that the modulator is always driven with the same amplitude of subcarrier, whether the signal comes from the Field Variable Phase circuit or the Field Fixed Phase circuit. The circuit also corrects for the symmetry of the waveform so that the modulator will be driven by a balanced signal.

The input signal is limited and fed to a paraphase amplifier. The Field Variable Phase subcarrier is limited to about 1.2 volts by Q8837 and diodes CR8839 and CR8843. The Field Fixed Phase subcarrier is limited by Q8781 and diodes CR8681 and CR8679. The squarewave outputs of the limitiers are ac coupled to the bases of paraphase amplifier Q8739 and Q8755. When the Field Phase Switch is in the Field Fixed Phase mode, the base of Q8739 is grounded, making the base of Q8755 the input of the paraphase amplifier. Alternatively, when in the Field Variable Phase mode, the base of Q8755 is grounded, and the base of Q8739 becomes the input of the paraphase amplifier.

R8655-C8653-C8657 and R8753-C8751-C8659 integrate and ac couple the output of the paraphase amplifier. The integration gives a triangular wave signal, and the ac coupling creates a 50% duty cycle.

The triangular wave output of the paraphase amplifier is fed to push-pull amplifier, Q8455-Q8551. The push-pull amplifier drives T8661 primary. The upper end of the secondary of T8661 feeds pin 8 of U8151, the B-Y modulator, and the 90° Quad Phase circuit. The lower end of the T8661 secondary is at ac ground, with a dc level of +9 volts.

90° Quad Phase

L8461, C8351, and C8459 form a phase-shift filter which is adjusted to delay the subcarrier 90°. This provides a subcarrier input to U8255, the R-Y modulator, which is 90° behind the phase of the subcarrier input of U8151, the B-Y modulator.

180° Phase Switch

This circuit determines whether the input to the R-Y modulator will go to pin 8 (negative input) or pin 7 (positive input) of U8255. In the normal condition, P8389 pins 2 and 3 are connected. Q8483 is turned on, and Q8485 and Q8479 are turned off. Q8577 is turned on, providing ac ground through C8481 to the subcarrier at pin 8 of U8255. The subcarrier from the 90° Quad Phase network is applied to pin 7 (positive input) of U8255, the R-Y modulator. Since the subcarrier to U8151 is fed to pin 8 (negative input), and we consider the +(B-Y) signal to be 0°, the +(R-Y) signal will be at +90°.

For test purposes, P8389 pins 1 and 2 may be connected. In this condition, the modified Window enable signal is applied to the base of Q8483. This signal is low for lines 66 through 218, and high for the rest of the field. Subcarrier is allowed at pin 7 of U8255 during the first and last part of the field, and at pin 8 during the center part of the field. This results in a 180° phase shift between the center of the field and the remainder of the field. C8677 balances the circuits for exactly 180° phase shift.

Modulators

There are two modulator integrated circuits in the 149A, U8151 for ±(B-Y), and U8255 for ±(R-Y). The subcarrier inputs, pin 7 (positive input) and pin 8 (negative input) provide the signal to be modulated. The signal inputs, pin 1 (positive input) and pin 4 (negative input) are fed with modulating signals. The subcarrier inputs are driven single-ended to the negative input on U8151, and the positive input on U8255. U8255 has a provision to switch between the two inputs for a 180° phase shift of the R-Y signals.

Q8333A & B, and Q8227A & B are input amplifiers for the ±(B-Y) and ±(R-Y) modulator inputs. Q8230A & B feed the output of the VIRS Filter to the +(B-Y) input circuit. Q8230B balances the input circuit and provides temperature compensation for Q8230A. R8135 and R8229 balance the modulators for minimum residual subcarrier.

The outputs of the modulators are tied together and applied to T8061. T8061 drives the Bandpass Filter, consisting of L8287, L8177, C8285, C8179, and R8077. The Bandpass Filter has a bandwidth of approximately 2.6 MHz, and a center frequency of 3.579545 MHz. The filter is adjusted to provide minimum harmonics of the subcarrier frequency, maximum amplitude and best risetime of the chrominance packets.

CW PHASE SHIFTER DIAGRAM ◇19◇ (147A)

The CW Phase Shifter circuit provides the subcarrier signal to the Modulator. The phase of the subcarrier is changed according to the type of signal to be generated.

Field Phase Switch

The Field Phase switch selects whether the subcarrier or the Modulator will be fed through the Field Fixed Phase circuit or the Field Variable Phase circuit. When a full-field signal is selected which includes the modulated pulse, output of the Field Variable Phase circuit is allowed to feed the modulator during the Mod Pulse portion of the line

programmed. Q8360 turns on, shunting the output of the Field Fixed Phase circuit. For all other conditions, when the modulated pulse is not enabled, the output of the Field Variable circuit will be shunted by Q8355, and the Field Fixed Phase circuit will provide the subcarrier to the Modulator.

Field Variable Phase

This stage allows a control range of greater than 180° (360° when P8860 is used) on the modulation of the modulated pulse.

Constant-current source Q8170 charges C8264, producing a linear ramp at the collector of Q8160 (which is off during the ramp) for an entire field. During the vertical interval, Q8160 is turned on, discharging C8264.

The ramp voltage is applied to the cathodes of variable-capacitance diodes CR8166 and CR8168. The voltage on the anodes of the diodes is between 0 and −2.5 volts dc, determined by the setting of R8060 (Mod Pulse Phase). As the ramp voltage increases, the capacitance of the diodes decreases. These diodes, in conjunction with L8150, L8050, and C8050, form two resonant filters. The phase of the subcarrier going through these filters is determined by the voltage on the variable-capacitance diodes. With a ramp on the cathodes of the diodes, the subcarrier phase will change throughout the field. If P8060 pins 2 and 3 are connected, +5 volts will be applied to Q8160, turning it on, discharging C8264, and keeping a ramp from being formed in this mode. The phase of the modulated pulse is determined by the setting of R8060 (Mod Pulse Phase).

The output subcarrier is applied to an ac-coupled limiter circuit in the AGC circuit. After the limiter, the Field Phase Switch will either pass the subcarrier on to the AGC circuit, or shunt it to ground.

Field Fixed Phase

This stage adjusts the phase of the subcarrier of all chrominance signals except the modulated pulse. Front-panel INSERT SUBCARRIER PHASE control R9210 sets the amount of reverse bias on variable-capacitance diode CR8189, which in turn sets the phase of the subcarrier going through R8188 and R8189. The output of the circuit goes to a limiting amplifier in the AGC circuit, where either the Field Variable Phase or the Field Fixed Phase is selected for feeding the Modulator.

AGC Amplifier

The AGC Amplifier ensures that the modulator is always driven with the same amplitude of subcarrier, whether the signal comes from the Field Variable Phase circuit or the Field Fixed Phase circuit. The circuit also corrects for the symmetry of the waveform so that the modulator will be driven by a balanced signal.

The input signal is limited and fed to a paraphase amplifier. The Field Variable Phase subcarrier is limited to about 1.2 volts by Q8350 and diodes CR8350 and CR8352. The Field Fixed Phase subcarrier is limited by Q8370 and diodes CR8375 and CR8378. The squarewave outputs of the limiters are ac coupled to the bases of the paraphase amplifier (Q8460 and Q8560). When the Field Phase Switch is in the Field Fixed Phase mode, the base of Q8460 is grounded, making the base of Q8560 the input of the paraphase amplifier. Alternatively, when in the Field Variable Phase mode, the base of Q8560 is grounded, and the base of Q8460 becomes the input of the paraphase amplifier.

R8550-C8470-C8555 and R8552-C8650-C8558 integrate and ac couple the output of the paraphase amplifier. The integration gives a triangular wave signal, and the ac coupling creates a 50% duty cycle.

The triangular wave output of the paraphase amplifier is fed to a push-pull amplifier (Q8570-Q8670). The push-pull amplifier drives T8660 primary. The secondary of T8660 feeds the + and − subcarrier inputs of the Modulator (U8890), shown on Diagram 18.

VIRS Detector

The program signal from Diagram 1 is fed to Q8020. The signal from the emitter of Q8020 is ac coupled to the bases of Q8120 and Q8130. These transistors also have open-collector inverters connected to them.

The VIRS Detector Enable, high for the line and field selected for detection (normally line 19 of field one), drives U8510C and D. VIRS Detector timing, low between Instants 6 and 18, drives U8510D and is inverted to drive U8510C.

R8030 is adjusted for Q8120 and Q8130 to be on the threshold of turning on. During VIRS modulation time, the base of Q8130 is held low, turning that transistor off. If VIRS is present on line 19, the detected chrominance will turn on Q8120. This low is fed through Q8110 as the VIRS Present signal to the VIRS Detect R-S flip-flop on Diagram 9.

When the VIRS Detector timing goes high at time 18, Q8130 can detect chrominance. If VIRS was detected, there will be no chrominance after time 18 to detect. If the signal detected was not VIRS, any chrominance after time

18 will turn on Q8130, which will send a low to reset the flip-flop on Diagram 9. The flip-flop will not show any VIRS as being present until after line 21.

Inverted 9 Line Keyout resets the flip-flop of each field, so that each field must be checked for VIRS.

VIRS DETECT, MOD PED, SUBC & SYNC OUT DIAGRAM 19 (149A)

The circuits on this diagram provide current for the Modulated Pedestal chrominance signal, VIRS Pedestal current, Composite Sync current, and Burst timing.

Modulated Pedestal Timing

The Modulated Pedestal Timing circuits are similar to those discussed in Diagrams 5 and 6. Plug-jumpers allow a choice of either the normal full-line modulated pedestal, or a half-line modulated pedestal.

Modulated Pedestal Modulation Amplitude

This stage consists of three current sources switched by the Modulated Pedestal Timing. The output of the current sources drives the +(R-Y) Modulator input on Diagram 18.

Sync Amplitude

Inverted Composite Sync turns off Q458 during sync time so that the Luminance Amplifier will be at its most negative level (−286 mV) at that time. At all other times, current flows through Q458. R455 (Sync Amplitude) is adjusted for 286 mV difference between the sync level and blanking level.

VIRS Pedestal Amplitude

This stage consists of a set of three current switches to generate the VIRS luminance pedestal.

The VIRS Enable signal goes low when VIRS is to be generated, allowing VIRS timing to operate the current switches. Currents from all three sources are added between Instants 6 and 18 to form the 70 IRE pedestal. Currents from Q469 and Q479 are summed between Instants 18 and 24 to form the 50 IRE pedestal. The 7.5 IRE pedestal is formed by the current from Q469 between Instants 24 and 30.

Burst Timing

This stage generates the burst timing pulse.

The trailing edge of inverted Composite Sync passes through C406 and turns off Q402. C406 charges through R406 at a rate that turns on Q402 after about 600 ns. The pulse formed at the collector of Q402 is fed by Q400 (via C404) to Q404. The trailing edge of the pulse turns off Q404, and C404 charges through R411 until Q404 turns on again. This occurs after about 2.2 μs. The resulting pulse at the collector of Q404 corresponds to the desired burst timing. U401D uses the 9 Line Keyout signal to gate out the Burst Timing pulses during the vertical sync time. The output of U401D is the Burst Timing signal, which goes to the modulator.

VIRS Detector

The program signal from Diagram 1 is fed to Q360. The signal from the emitter of Q360 is ac coupled to the bases of Q450 and Q460. These transistors also have open collector inverters connected to them.

The VIRS Detector Enable, high for the line and field selected for detection (normally line 19 of field one), drives U401B and C. VIRS Detector timing, low between Instants 6 and 18, drives U401C and is inverted to drive U401B.

R450 is adjusted for Q450 and Q460 to be on the threshold of turning on. During VIRS modulation time, the base of Q460 is held low, turning that transistor off. If VIRS is present on line 19, the detected chrominance will turn on Q450. This low is fed through Q470 as the VIRS Present signal to the VIRS Detector R-S flip-flop on Diagram 9.

When the VIRS Detector timing goes high at time 18, Q460 can detect chrominance. If VIRS was detected, there will be no chrominance after time 18 to detect. If the signal detected was not VIRS, any chrominance after time 18 will turn on Q460, which will send a low to reset the flip-flop on Diagram 9. The flip-flop will not show any VIRS as being present until after line 21.

Inverted 9 Line Keyout resets the flip-flop each field, so that each field must be checked for VIRS.

SYNC & SUBCARRIER OUTPUT AMPLIFIERS DIAGRAM 20

The circuitry on this diagram includes the CW SUBCARRIER OUT and COMPOSITE SYNC OUT connector drive circuits, the Sync Lock Detector circuit, and the Sync Generator circuit.

Sync Generator

Regenerated sync should be contrasted with separated sync. The latter is stripped from the incoming program signal and therefore contains the identical timing information of that signal, including any jitter if present. The timing for regenerated sync is derived from the internal timing circuits of the 147A or 149A, and is present even in the absence of an incoming signal.

The train of pulses that form the regenerated sync signal are formed in monostable multivibrator U201. There are basically two inputs to this multivibrator: one is a trigger or timing input, which determines the leading edge time location of each of its output pulses (Horizontal Sync). The other input determines the width of the pulse (Vertical Sync).

The standard composite sync signal requires that the trigger pulses appear at a line repetition-rate during most of the active field, including most of the vertical blanking interval. However, during the 9 line interval that includes the equalizing pulses and the vertical sync pulse, the timing information rate must be doubled to twice line rate. Similarly, the width of the regenerated sync pulses must be of line sync width during the active portion of the field, including most of the vertical blanking interval, but must be appropriately narrowed for the equalizer pulses and widened to produce the serrated vertical pulse.

The pulse width of monostable multivibrator U201 is determined by three current paths into the pulse width timing capacitors C330-C335. R350 and R335 provide current at all times, and represent the minimum amount required for the production of the serrated vertical pulses. A second path, controlled by Q230, supplies additional current when normal line-rate sync pulses are required. This transistor is driven by a 9 Line Keyout pulse, which stops flow of current during the 9 line interval around the vertical sync pulse.

The third current path is supplied with a complex signal that steers the largest amount of current into the monostable multivibrator during the first and last 3 lines of the vertical sync interval. During the middle 3 lines of this interval, the current is interrupted, leaving only the steady minimum value to produce the serrated pulses.

The logic to produce that control signal comes from the vertical sync circuit. Two characteristic instant pulses drive U301A, producing a twice-line rate timing signal. This timing signal is applied to the trigger input of counter U101. This counter is connected to count by 6, producing an output after the sixth timing pulse at its input. The output pulse lasts for a period of six more twice-line rate pulses, and is combined by U21C with the 9 Line Keyout pulse to first produce a high, then a low, then a high, corresponding to each third of the 9 line interval. This output occurs only once per field (since the 9 line signal itself is used to reset the counter during active field time), and is inverted and applied to the base of Q240 to control the necessary current to produce equalizer and serrated pulses.

The timing pulses to trigger the monostable multivibrator are formed by sections of U301. Again, the 9 Line Keyout pulse is required, since the timing during this interval is twice-line rate and outside this interval, at the line rate. U301D acts as an OR gate, receiving a characteristic instant on pin 13, which produces line-rate triggers. During the 9 Line Keyout interval, U301C permits the passage of a second characteristic instant into pin 12 of U301D. The output then contains twice-line rate triggers during the 9 line interval. Timing control and width control has therefore produced a standard train of composite sync pulses at the output of monostable multivibrator U201.

Sync Lock Detector

This stage is used to sense any difference between the internally-generated composite sync (pin 6 of U201) and the reprocessed composite sync (P101-1 via the Sync Separator). U21B looks for coincidence between these two signals. Any difference will cause Q260, Q250, Q350, Q355, and Q319 to be in a condition which (1) turns on the NONSYNCHRONOUS MODE - NO VITS Lamp, (2) disables the Quad Demodulator stage (see Diagram 12), (3) inhibits pins 12 and 13 of the Program VITS Switch (see discussion for Diagrams 1 & 2), (4) inhibits composite sync to the COMPOSITE SYNC OUT connector, and, most important, (5) switches the input relay so that the PROGRAM LINE IN is shunted to the PROGRAM LINE OUT.

Composite Sync Output Amplifier

CR8 and Q10 form a current switch. When CR8 is reverse biased, current through R7 is diverted through Q10, which drives the filter. The filter limits the risetime of the composite sync signal.

Q55, Q30, and Q40 are the active components of an operational amplifier. R32 is the feedback resistance; the input current is determined by R7. Q50 provides current for reverse-terminating any negative pulses that may appear at the output terminal due to unterminated coaxial cables.

Subcarrier Output Amplifier

Emitter follower Q80 serves as a buffer and driver. It isolates the oscillator (see Diagram 13) from the output. Because Q80 is biased near cutoff, it clips the negative portion of the input signal so that the drive signal to Q90 pulses the collector tank circuit.

The output from the tank drives an operational amplifier consisting of Q70 and Q160. This circuit serves as a distribution amplifier to drive the various circuits within the 147A or 149A, plus the CW SUBCARRIER output. Q60 sets the level at the emitter of Q70 and provides temperature compensation.

Reed Switch

A relay, K390, opens the CW SUBCARRIER output line in the event burst is lost from the driving source. (See the Operating Instructions for exception.)

POWER SUPPLY DIAGRAM 21

The Low Voltage Power Supply circuit provides three regulated supplies; +15 volts, +5 volts, and −15 volts. Electronic regulation is used to provide stable, low ripple output voltages. All the supplies are current-limited to prevent instrument damage in the event that a supply is shorted to ground. The primary circuit of the transformer employs voltage and range selector plugs to permit selection of the appropriate line voltage operating range.

Power Input

Power is applied to the primary winding of transformer T9001 via RFI Filter FL9201, POWER switch S9201, 115-volt line fuse F9201, Voltage Selector S9203, and Range Selector S9202. The voltage selector plug connects the split primaries of T9001 in parallel for the 115-volt range of operation, or in series for 230-volt operation. A second fuse, F9202, is placed in the 230-volt position to provide the correct protection for 230-volt operation.

The Range Selector plug allows the instrument to regulate properly on higher or lower than normal line voltages. Each half of the primary has taps above and below the 115-volt (230) point. As the selector is moved from LO, M, to HI, more turns are added to the primary winding. Therefore, whether the primary voltage has increased or decreased, the secondary voltage can be maintained at a nearly constant level:

$$Es = Ep \times \frac{NS}{NP}$$

The RFI Filter serves to prevent external RF interference from appearing across T9001 and also prevents signals generated within the instrument from being introduced into the ac line.

−15 V Supply

The −15 volt supply provides the reference voltage for the +5 and +15 volt supplies. The reference for the −15 volt supply is a 9.1 volt zener diode, VR9850.

The output from the secondary winding (pins 6 and 7 of P9850) is rectified by a full-wave bridge rectifier consisting of CR9870, CR9872, CR9874, and CR9876. The rectified voltage is filtered by C9061 and applied through a −15 volt series regulator stage, Q9085, to the load. Series regulator Q9085 and its driver, Q9850, are controlled by a voltage comparator consisting of Q9856 and Q9854 with associated components.

Q9856 in the voltage comparator is referenced to −6 volts, supplied by 9.1 volt zener diode VR9850, and R9858. C9852 filters any noise generated by the zener. The current through R9852 is shared by Q9856 and Q9854. The amount of current going to each transistor is determined by the resistor network at the base of Q9854. The network consists of R9854, R9856, R9864 and the −15 volt adjustment (R9851). As Q9854 takes more or less current, depending upon the setting of R9851, Q9856 will lose or gain current. The collector of Q9856 feeds the driver transistor, Q9850, which in turn drives series regulator Q9085. The series regulator supplies current to the load, and maintains a constant voltage through the action of the comparator. R9868 and C9856 suppress any tendency for the voltage comparator to oscillate.

Overload protection is provided by Q9852 and associated components. This transistor is normally cut off. If the −15 volt supply current is excessive, current through R9874 develops enough voltage to forward bias Q9852, reducing the drive to Q9850, and limiting the amount of current through Q9085.

+5 Volt Supply

The +5 volt supply operation is similar to the −15 volt supply. The output from the center-tapped secondary winding is rectified by a full-wave rectifier consisting of CR9802 and CR9804. POWER ON indicator DS9201 receives power from the secondary winding through limiting resistor R9803. The remaining circuits operate in the same manner as the −15 volt supply.

+15 Volt Supply

The +15 volt supply operation is similar to the −15 volt supply.

RACKMOUNTING

RACKMOUNTING INSTRUCTIONS

Mounting Methods (Figs. 5-1, 5-2, 5-5 and 5-6)

The instruments will fit most commercial consoles and most 19-inch wide racks whose front and rear rail holes conform to Universal, EIA, RETMA and Western Electric hole spacing.

Fig. 5-1 shows the instrument installed in a cabinet-type rack with 1 3/4-inch wide slide-out tracks for a non-tilt installation. The instrument is secured into the rack by means of four captive thumb screws. When the thumb screws on the front panel are loosened, the instrument can be pulled out of the rack like a drawer to its fully extended position (see Fig. 5-2). This position permits many routine maintenance functions to be performed without completely removing the instrument from the rack.

The slide-out tracks easily mount to the cabinet rack front and rear vertical mounting rails if the inside distance between the front and rear rails is within 10 1/2 to 24 1/2 inches. Some means of support (for example, make extensions for the rear mounting brackets) is needed for the rear ends of the slide-out tracks if the tracks are going to be installed in a cabinet rack whose inside dimension between front and rear rails is not the proper distance (10 1/2 inches to 24 1/2 inches).

Instrument Dimension

The last page in this section shows dimensional drawings exclusive of the power cord and cables.

Width—A standard 19-inch rack may be used. The dimension or opening between the front rails must be at least 17 5/8 inches (see Fig. 5-2) for a cabinet rack in which the front lip of the stationary section is mounted behind an untapped front rail as shown in the right-hand illustration of Fig. 5-6. This dimension allows room on each side of the instrument for the slide-out tracks to operate so the instrument can move freely in and out of the rack.

Depth—For proper circulation of cooling air, allow at least 2 inches clearance behind the rear of the instrument and any enclosure on the rack (see dimensional drawing). If it is sometimes necessary or desirable to operate the generator in the fully extended position, use cables that are long enough to reach from the instrument to the location where the signal(s) is to be applied.

Rackmounting in a Cabinet Rack

General Information—The slide-out-tracks for the instrument consists of two assemblies, one for the left side of the instrument and one for the right side. Each assembly consists of three sections as illustrated in Fig. 5-3. The stationary section attaches to the front and rear rails of the rack with inside dimensions as indicated in Fig. 5-2; the chassis section attaches to the instrument and is installed at the factory; the intermediate section fits between the other two sections to allow the instrument to be fully extended out of the rack.

The small hardware components included with the slide-out track assemblies are shown in Fig. 5-4. The hardware shown in Fig. 5-4 is used to mount the slide-out tracks to the rack rails having this compatiblity.

a. Front and rear rail holes must be large enough to allow inserting a 10-32 screw through the rail mounting holes (see Fig. 5-6).

b. Front rail holes may have already been countersunk prior to this installation.

Because of the compatibility given in (b), there will be some screws left over.

The stationary and intermediate sections for both sides of the rack are shipped as a matched set and should not be separated. The matched sets for both sides including hardware are marked 351-0195-00 on the package. To identify the assemblies, note that the automatic latch and intermediate section stop are located near the top of the matched sets when they are properly mated to the chassis sections as shown in Fig. 5-3.

Mounting Procedure—Use the following procedure to mount both sets. See Figs. 5-5 and 5-6 for installation details.

Rackmounting—140 Series

1. To mount the instrument directly above or below another instrument in the cabinet rack, select the appropriate holes in the front rack rails for the stationary sections using Fig. 5-5 as a guide.

2. Mount the stationary slide-out track sections to the front rack rails using either of these methods:

a. If the front rails are not countersunk, use the pan head screws and bar nuts to mount the stationary sections similar to the right-hand illustration shown in Fig. 5-6.

b. If the front rails are countersunk, use the flat head screws and bar nuts to mount the stationary sections as shown in Fig. 5-6 right-hand illustration.

3. Mount the stationary slide-out track sections to the non-tapped rear rails using this method:

a. Mount the left stationary section with hardware provided as shown in the left-hand or center illustration in Fig. 5-6. Note that the rear mounting bracket can be installed either way so the slide-out tracks will fit a deep or shallow cabinet rack.

b. Use Fig. 5-6 as a guide for mounting the right stationary section. Make sure the stationary sections are horizontally aligned so they are level and parallel with each other.

Adjustments

To adjust the slide-out tracks for smooth operation, proceed as follows:

1. Insert the instrument into the rack as described and as shown in steps 1 through 4 of Fig. 5-7 installation procedure.

2. Adjust the slide-out tracks for proper spacing as shown in Fig. 5-8.

Maintenance

The slide-out tracks require no lubrication. The special dark grey finish on the sliding parts is a permanent lubrication.

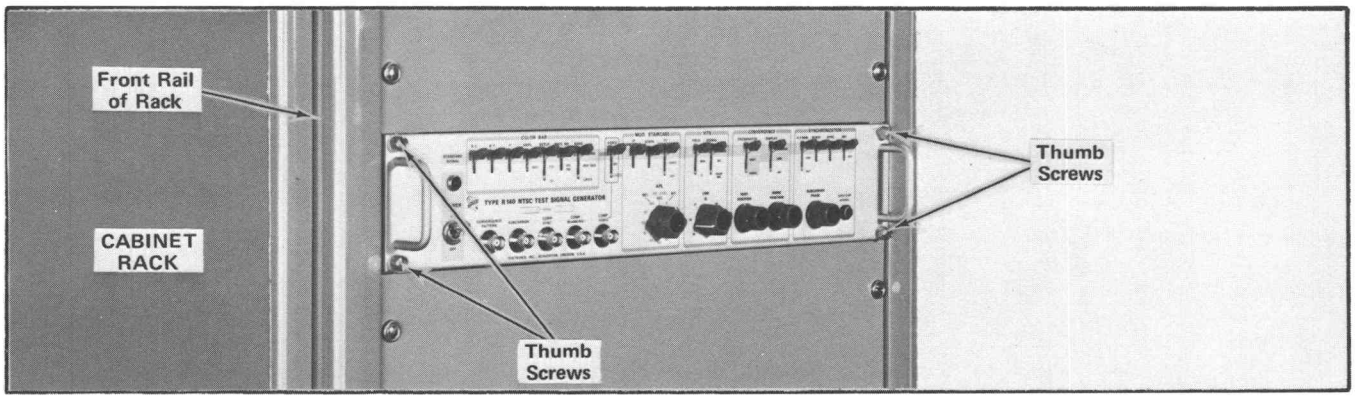


Fig. 5-1. The generator installed in a cabinet rack.

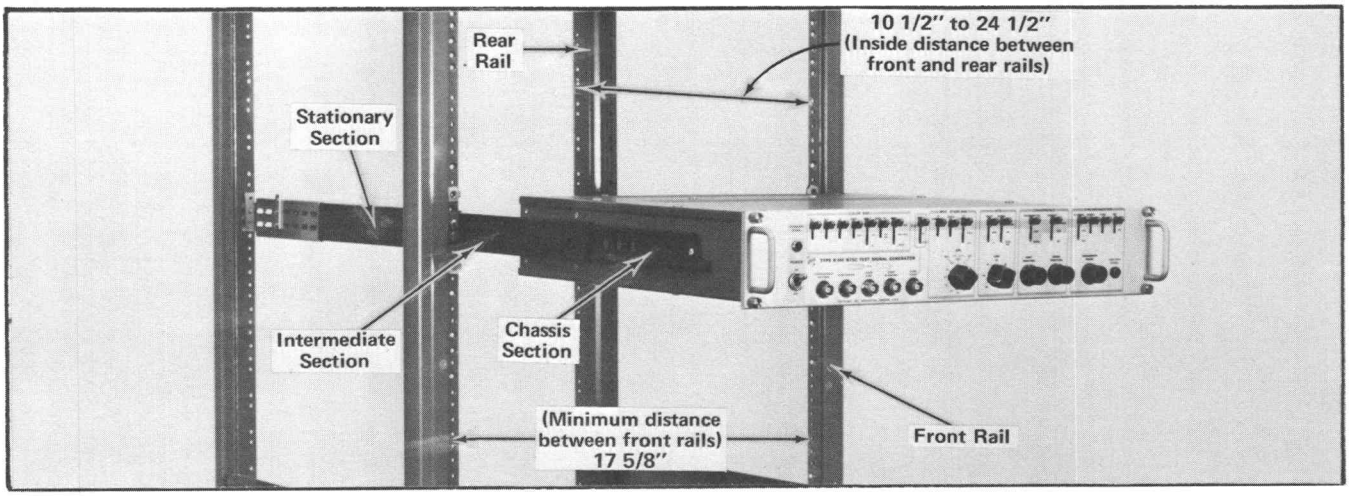


Fig. 5-2. The generator shown in the fully extended position. The cabinet rack slides have been removed from the rack to show mounting.

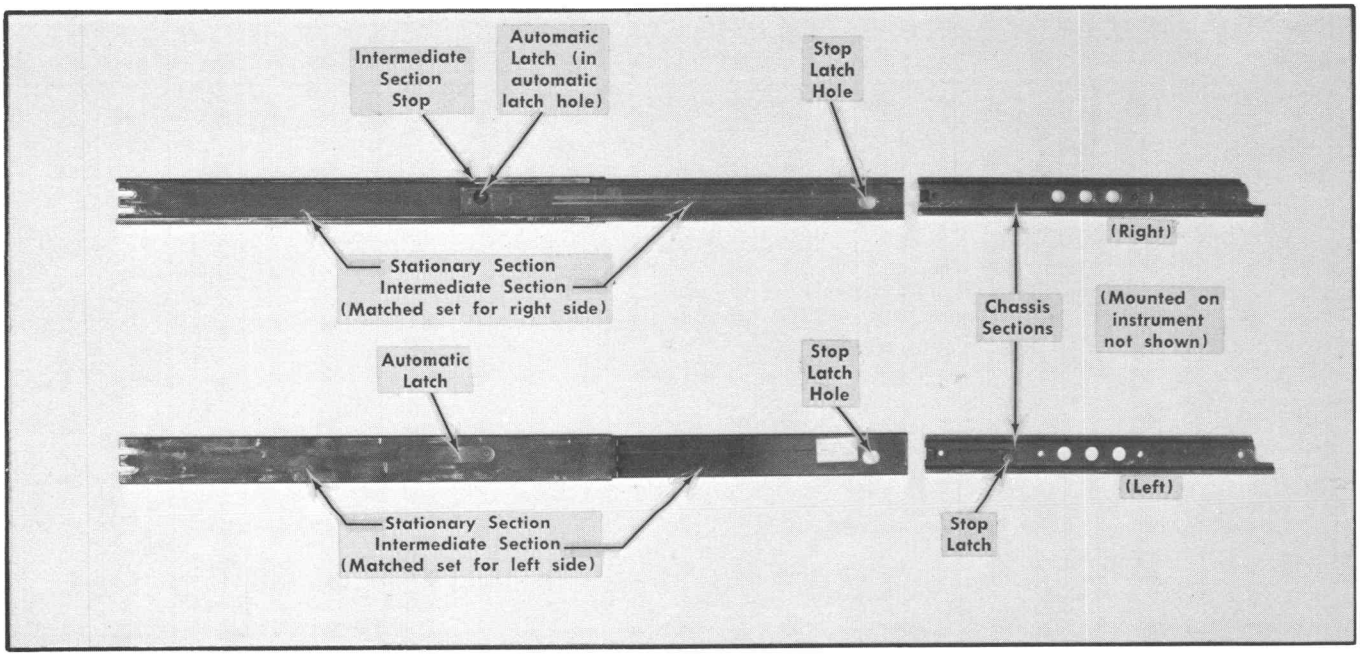


Fig. 5-3. Illustration showing the 1 3/4-inch wide slide-out track assemblies.

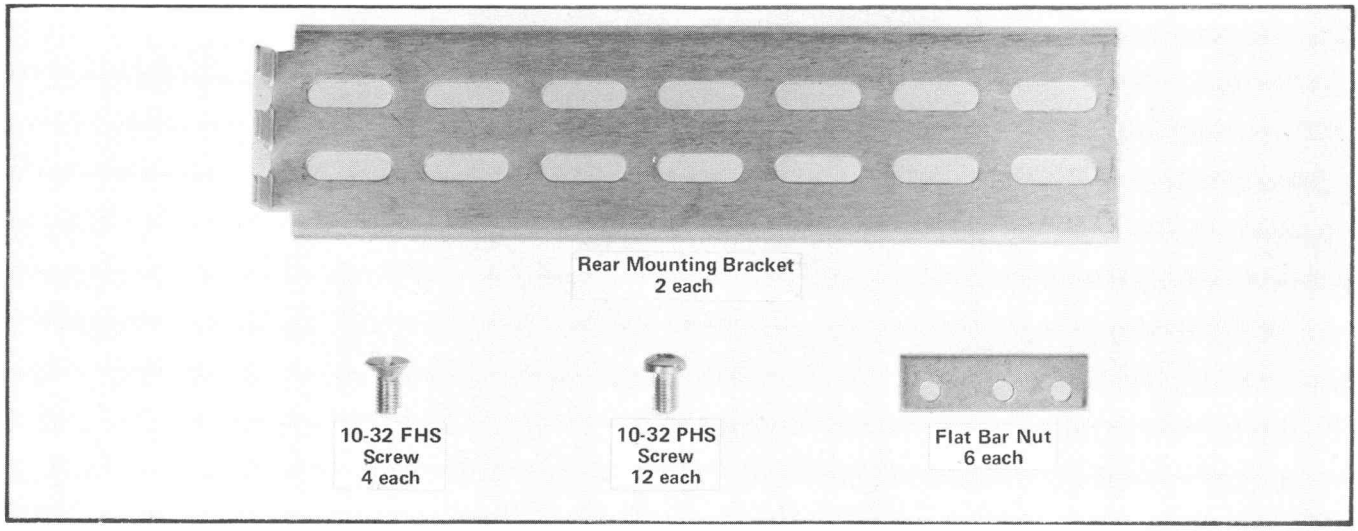


Fig. 5-4. Small hardware components for mounting the stationary sections to the rack rails.

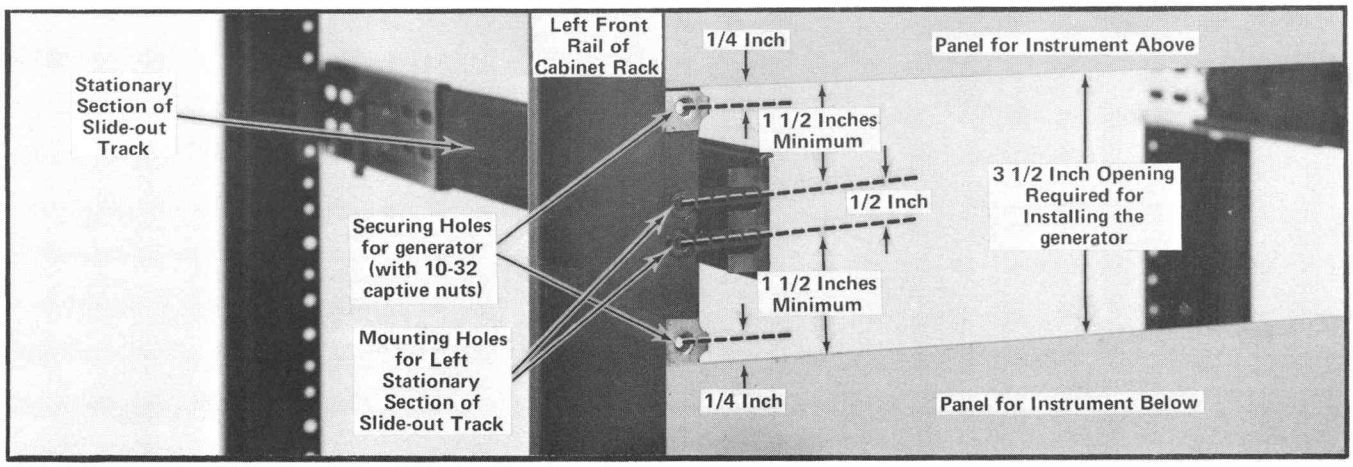


Fig. 5-5. Vertical mounting position of the left stationary section and location of the securing holes. These same dimensions apply to the right front rail.

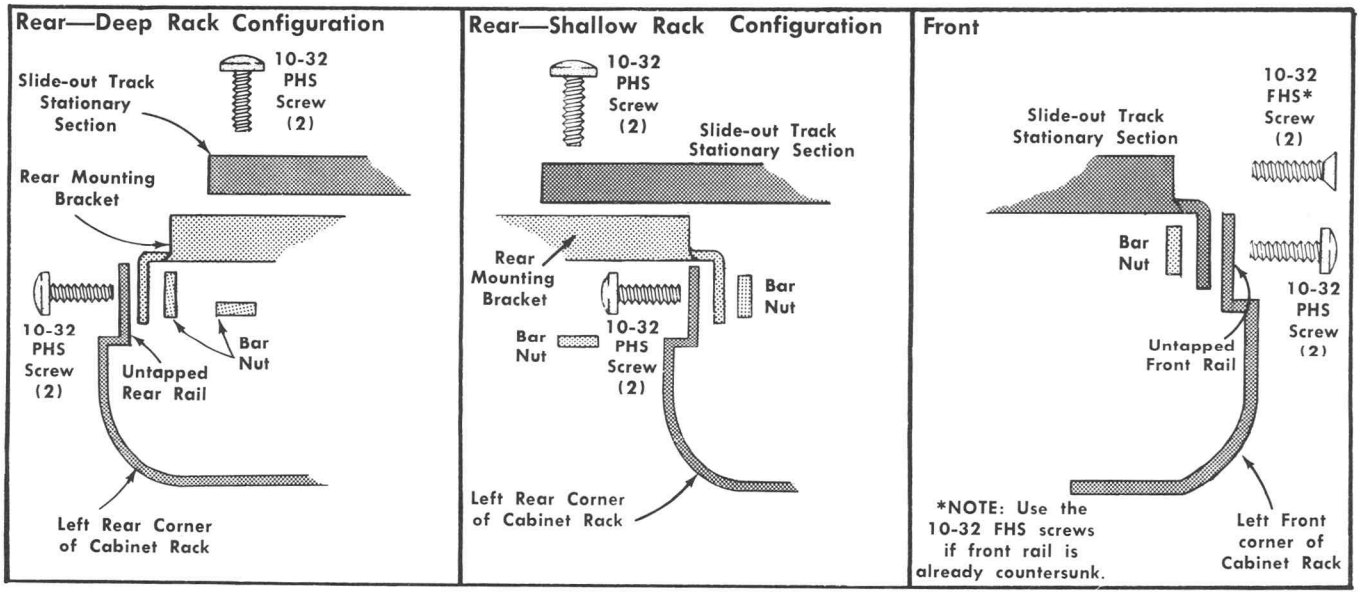


Fig. 5-6. Top view of cabinet rack showing mounting position of the left stationary section to the rails of the rack. Since the rails are not tapped, bar nuts are used to mount the stationary section to the rack rails.

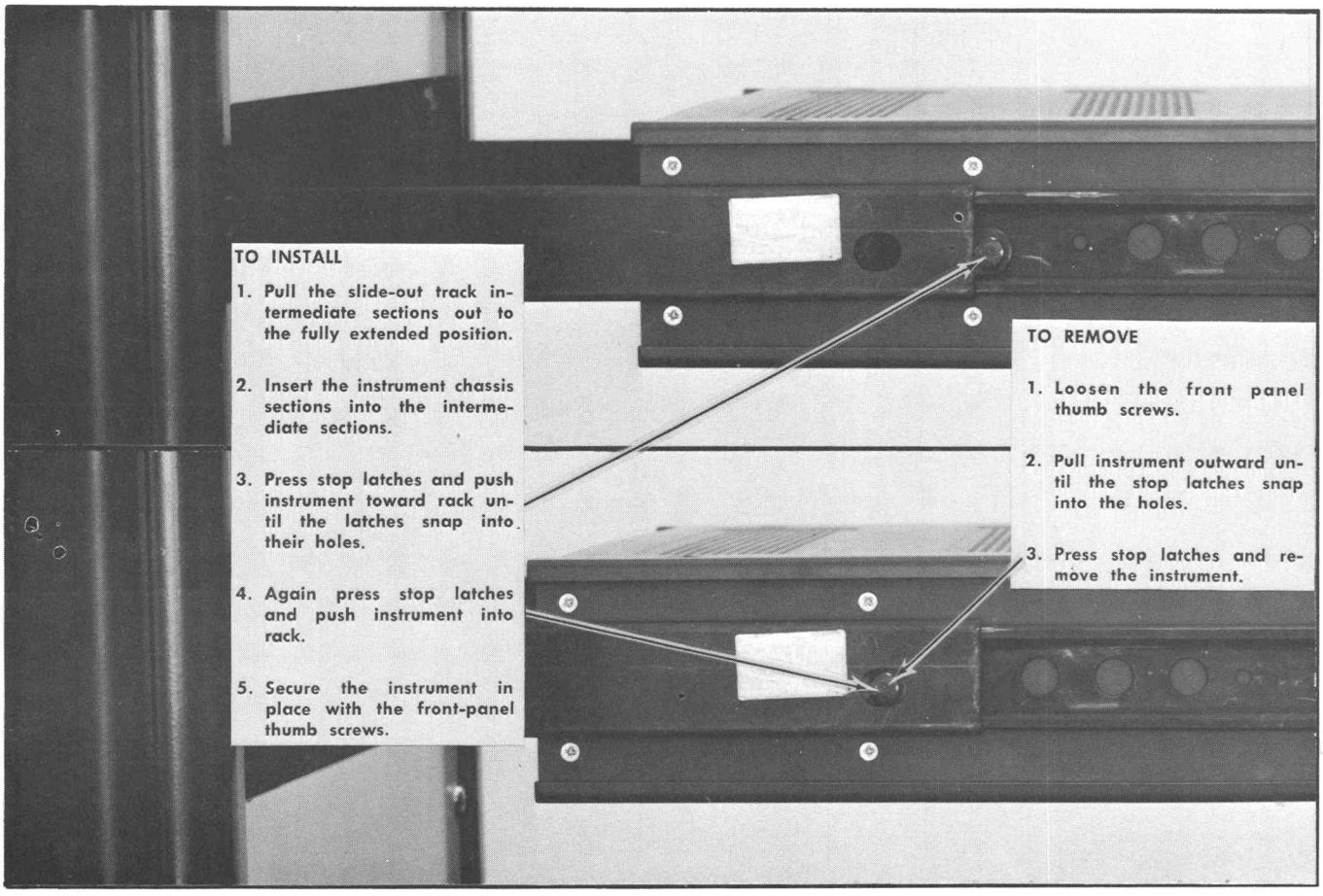


Fig. 5-7. Installing and removing the instrument.

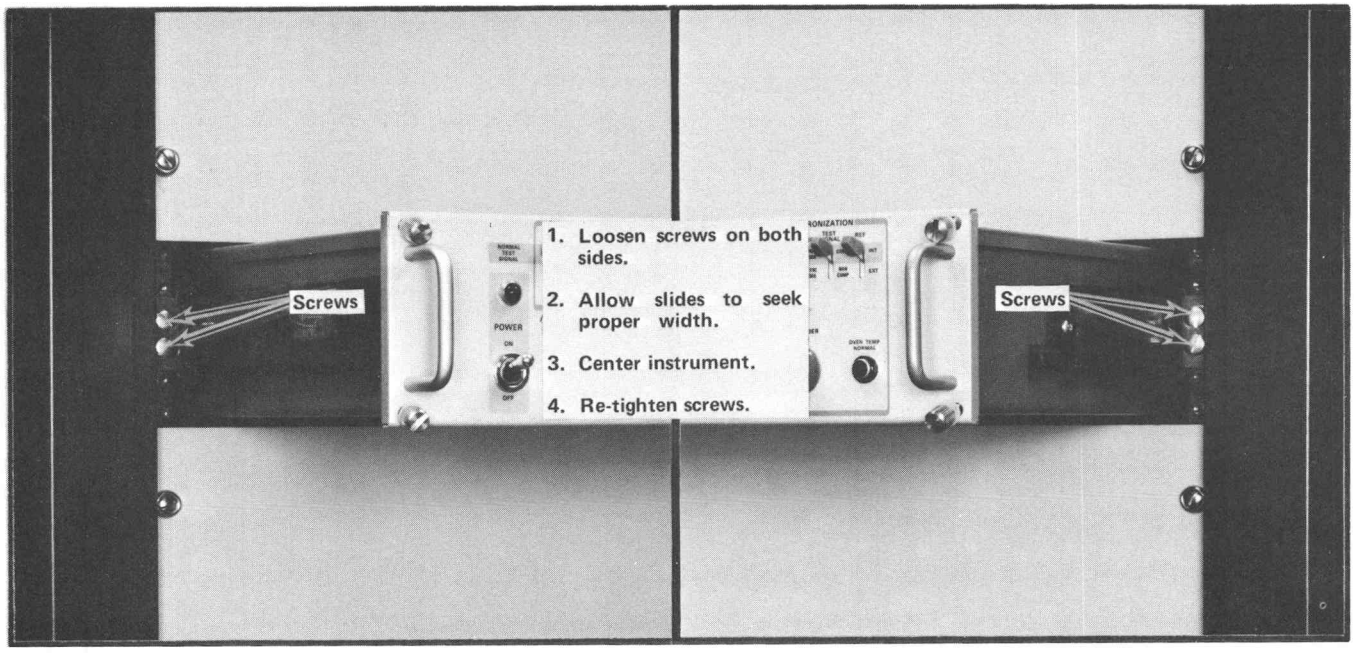
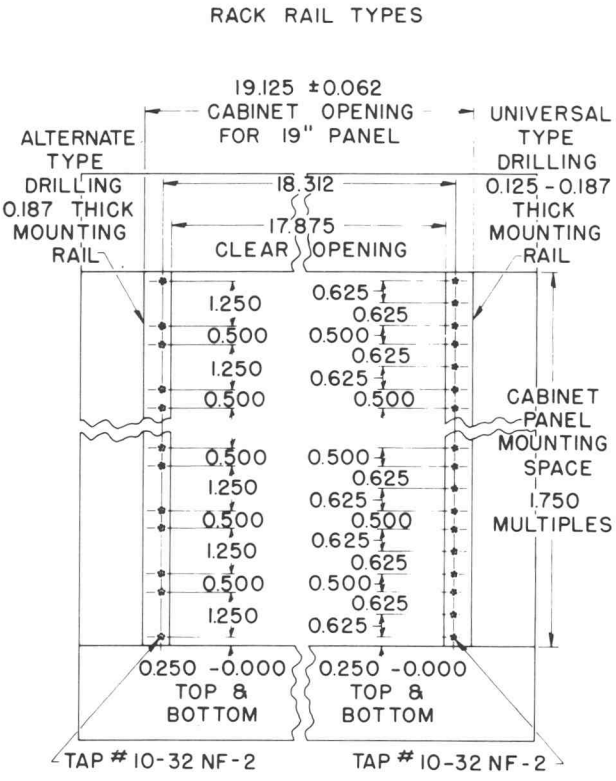
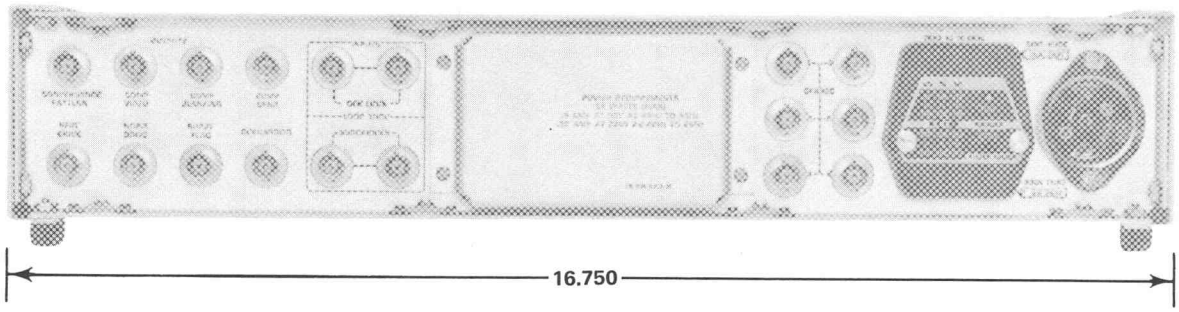
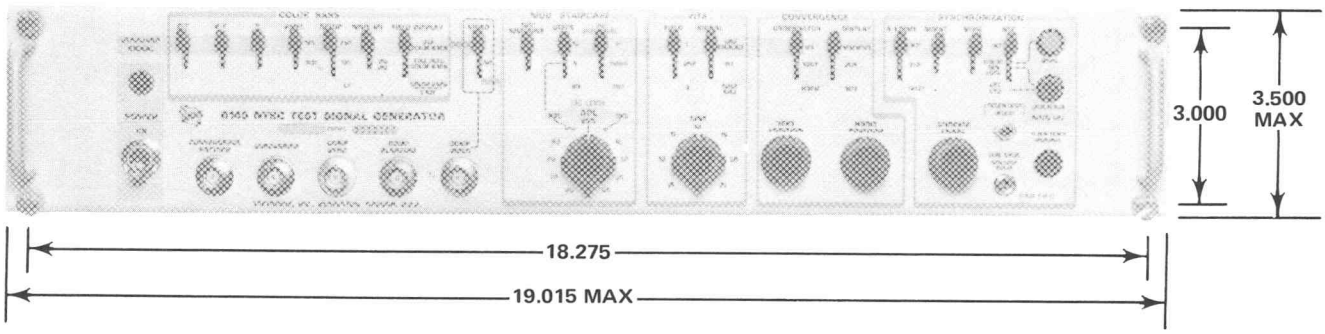


Fig. 5-8. Adjusting the slide-out tracks for smooth sliding action.

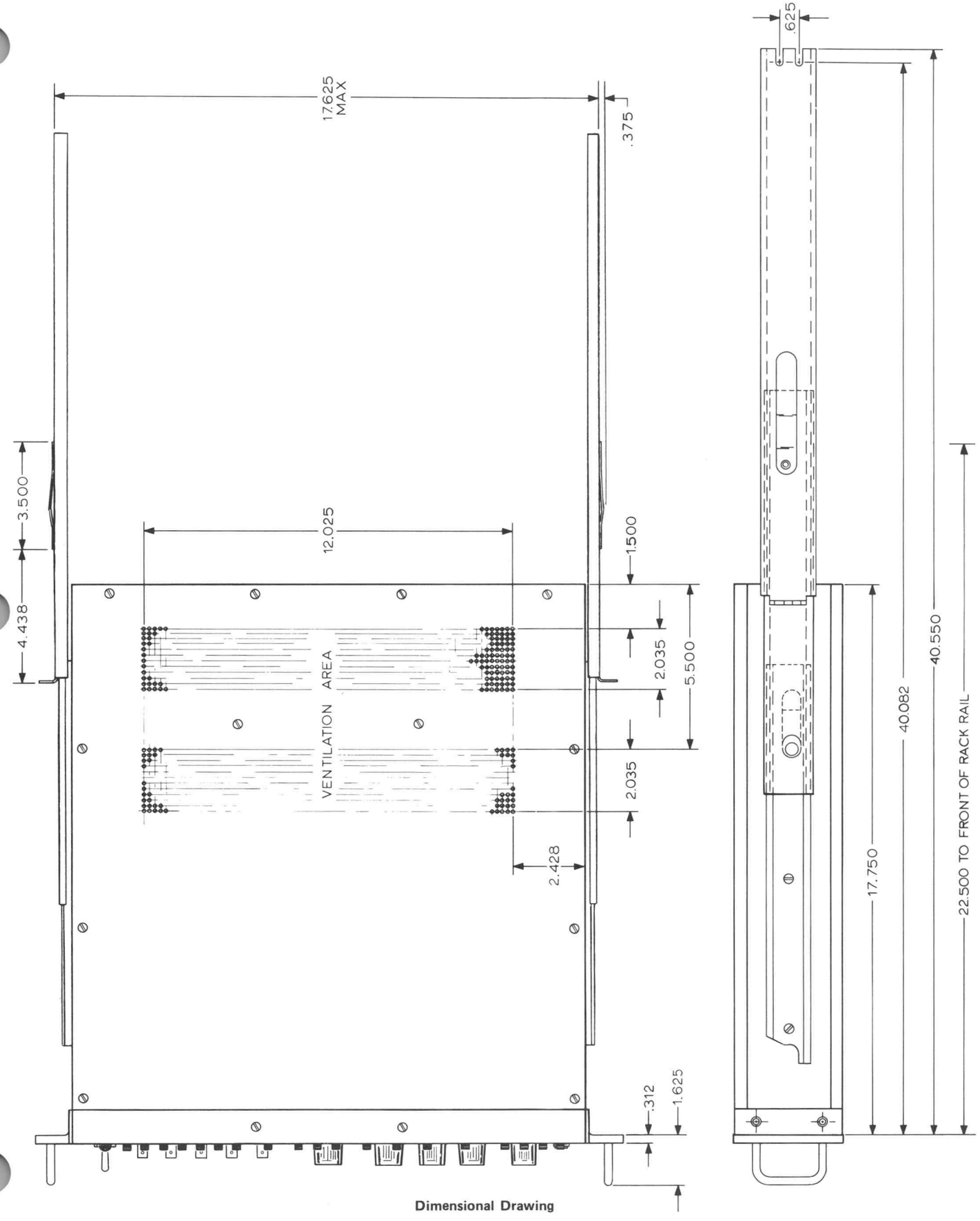






Dimensional Drawing

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Dimensional Drawing

OPTIONS

This section provides for documenting catalog options offered for the 147A and 149A. Custom modifications are negotiated and documented separately.

147A OPTION 1
TRANSMITTER REMOTE CONTROL SIGNALS

The 147A Option 1 is programmed in compliance with FCC Rules and Regulations §73.676 (f) for remote control monitoring of transmitters.

Fig. 6-1 shows the three signals stipulated in §73.676. The 147A will generate the Multiburst and Composite Test Signals, but the Color Bar Test Signal must be externally applied to the 147A. (A Tektronix 140 or similar will provide the required Color Bar signal.)

As shipped from the factory, the 147A Option 1 VITS will be programmed as follows (see Fig. 1-14 for the location of the VITS Line and Field Selector plugs):

VIRS—Line 19, Fields 1 & 2 (blue connector).

NOISE—Line 20, Field 2 (green connector).

MULTIBURST—Line 17, Field 1 (yellow connector).

COMPOSITE—Line 18, Fields 1 & 2 (orange connector).

SPARE 2—Line Off, Field 1, P4810 pins 2 & 3 (red connector).

SPARE 1—Line 17, Field 2, P4820 pins 1 & 2 (brown connector).

In addition to the VITS programming, the following changes have been made.

a. Pin 21 of P9014 (REMOTE) has been disconnected (see Fig. 1-3). This prevents internal VIRS from being inserted in the Program Line. To allow VIRS to be inserted, connect pin 21 to pin 12 of P9014 as shown in Fig. 1-3.

b. The 2T Bar will be displayed in place of the T Bar. See the 2T/T Bar instructions in the Operating Changes part of Section 1.

c. The second and last burst frequencies of the MULTIBURST signal have been changed to 1.25 MHz and 4.1 MHz respectively. See the calibration procedure in Section 3 of this manual for the adjustment procedure.

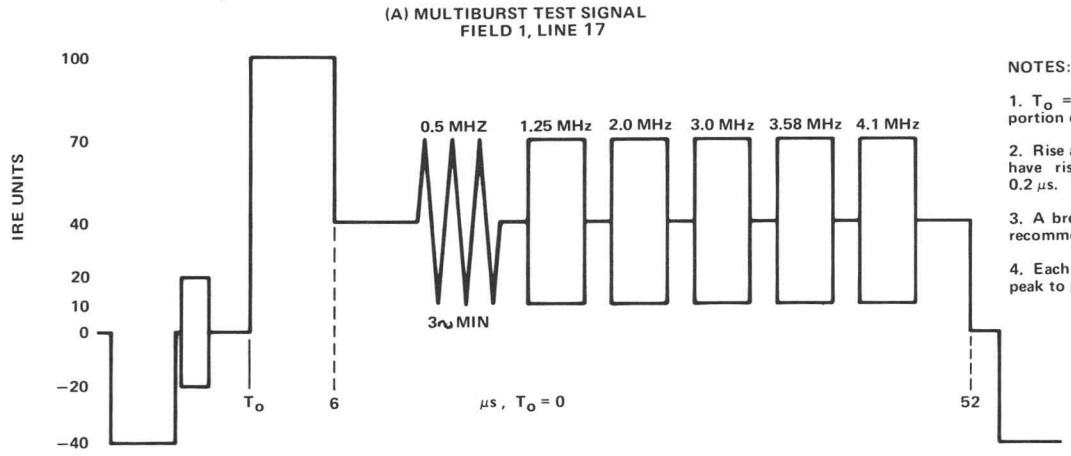
d. The 12.5T VITS Phase (Fields 1 & 2, Line 18) has been set to correspond to the Magenta hue (approximately 61° from the B-Y axis at 0° on a vectorscope). To accomplish this, P8860 (Mod Pulse Phase Advance) is connected in the 0° ±90° position (see Fig. 1-23), and adjusted by R8060 (Mod Phase).

Operation of the 147A Option 1 is identical with that of the standard 147A, as given in the First Time Operating Instructions in Section 1, except as follows:

1. The MULTIBURST AMPLITUDE switch must be set to REDUCED.

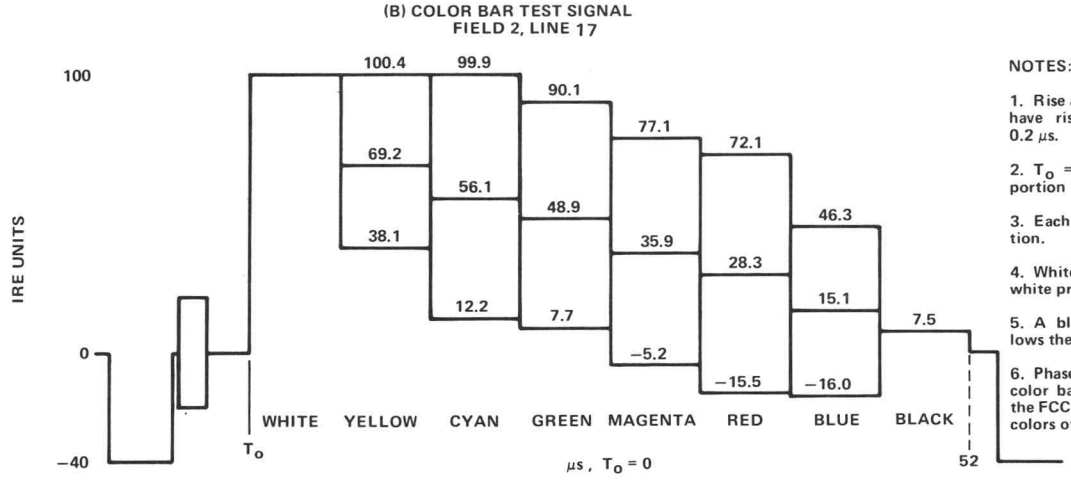
2. An external Color Bar VITS on Line 17, Field 2 must be applied to the 147A rear panel EXT VITS IN.

3. The NOISE switch should be set to INSERTION (1/2 Line).



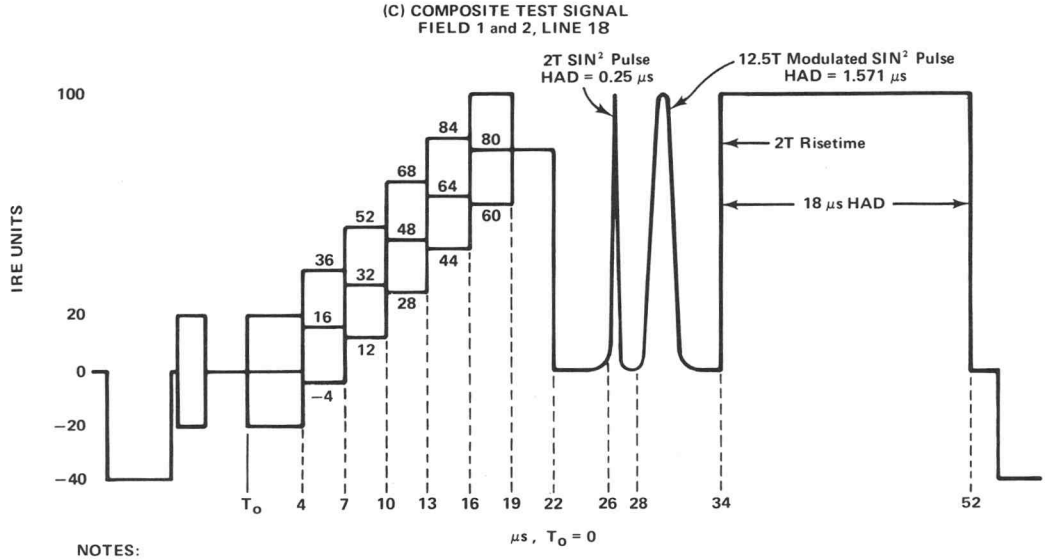
NOTES:

1. T_o = Nominal start of active portion of Line 18, Field 1.
2. Rise and Fall of white bar shall have risetime of not less than 0.2 μs.
3. A breezeway between bursts is recommended.
4. Each burst packet = 60 IRE peak to peak.



NOTES:

1. Rise and Fall of white bar shall have risetime of not less than 0.2 μs.
2. T_o = Nominal start of active portion of Line 18, Field 2.
3. Each bar 6 μs minimum duration.
4. White flag (bar) at reference white precedes the color bars.
5. A black burst setup level follows the color bars.
6. Phases and amplitudes of the color bars are in accordance with the FCC R & R for 100% saturated colors of 75% Amplitude.



NOTES:

1. T_o = Nominal start of active portion of LINE 18, Field 1 and Field 2.
2. Rise and decay of all luminance signals not less than 0.2 μs.
3. Rise and decay of envelope of sub-carrier component of staircase signal shall be ≈SIN² shaped and risetime .375 μs.

Fig. 6-1. Test signals to be generated and inserted in the vertical interval for Remote Control Monitoring. Reference: FCC Rules and Regulations, Section 73.676 (f) Figures 13, 14, and 15 of Section 73.699: Amended Part 73 of the Rules and Regulations, October 5, 1971.

149A OPTION 1
INTERNATIONAL TEST SIGNALS

The 149A Option 1 is programmed for international test signals, as specified by CMTT-B-1 Annex II (see Fig. 6-2). This involves changing the Composite, Multiburst, and Modulated Pedestal signals.

As shipped from the factory the 149A Option 1 VITS will be programmed as follows (see Fig. 1-14 for the location of the VITS line and field selector plugs):

Composite	Line 17, Field 1
Multiburst and Mod Ped	Line 17, Field 2
VIRS Incoming	Line 19, Fields 1 and 2

In addition to the VITS programming, the following changes have been made to the standard 149A.

a. Pin 21 of the REMOTE plug, P9014, has been disconnected (see Fig. 1-3). This prevents internal VIRS from being inserted in the Program line. To allow VIRS to be inserted, connect pin 21 to pin 12 of P9014 as shown in Fig. 1-3.

b. Color Bars signal is programmed off.

c. The Composite signal is programmed as shown in Fig. 6-2.

d. The Multiburst and Modulated Pedestal signals are programmed on the same line, with the timing, frequency, and amplitude changes as shown in Fig. 6-2.

CALIBRATION PROCEDURE CHANGES

The 149A Option 1 is calibrated the same as the standard 149A with the following exceptions:

Group 3—Luminance

The 5 Step Linearity signal is adjusted for 642.9 mV within 7.14 mV (90 IRE within 1 IRE).

Group 7—Multiburst

The second multiburst packet is adjusted to 1.0 MHz within 3% (2 cycles in 10 divisions within 0.3 division at .2 μs/Div).

The sixth multiburst packet is adjusted to 4.2 MHz within 2% (3 cycles in 7.00 to 7.28 divisions at .1 μs/Div).

The Multiburst Center Level is adjusted to 357.1 mV within 7.14 mV (50 IRE within 1 IRE) in both the FULL and 60 IRE positions of the MULTIBURST AMPLITUDE switch.

The Multiburst packet amplitude in FULL is adjusted to 714.3 mV within 7.14 mV (100 IRE within 1 IRE).

The Multiburst packet amplitude in the 60 IRE position is adjusted to 357.1 mV within 7.14 mV (50 IRE within 1 IRE).

DIAGRAMS AND PARTS LISTS

The corresponding schematic diagrams should be changed to show the following parts value changes. The location of CR491 and CR492 on the schematic diagram is shown in Fig. 6-3.

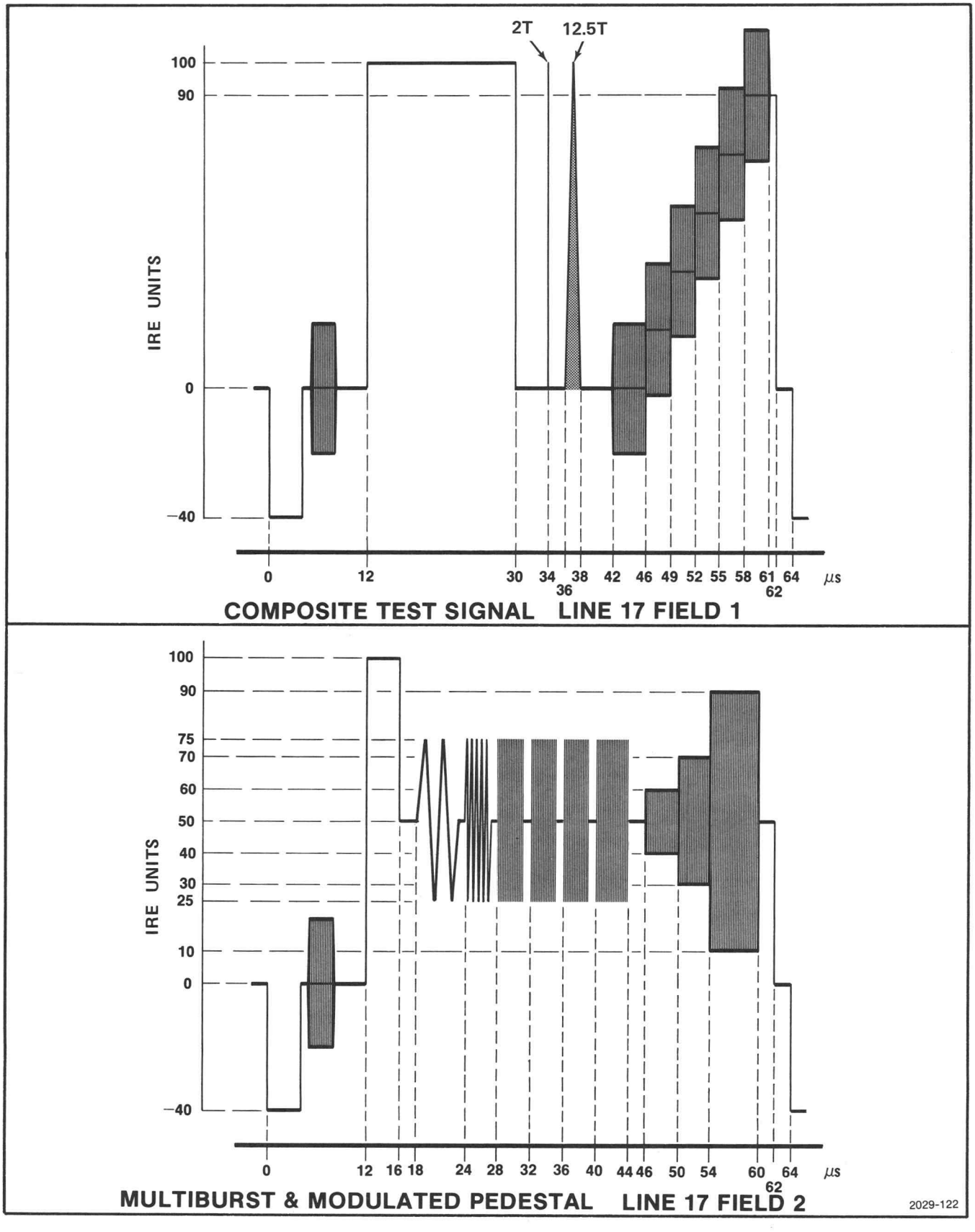


Fig. 6-2. International test signals, as specified by CMTT-B-1 Annex II.

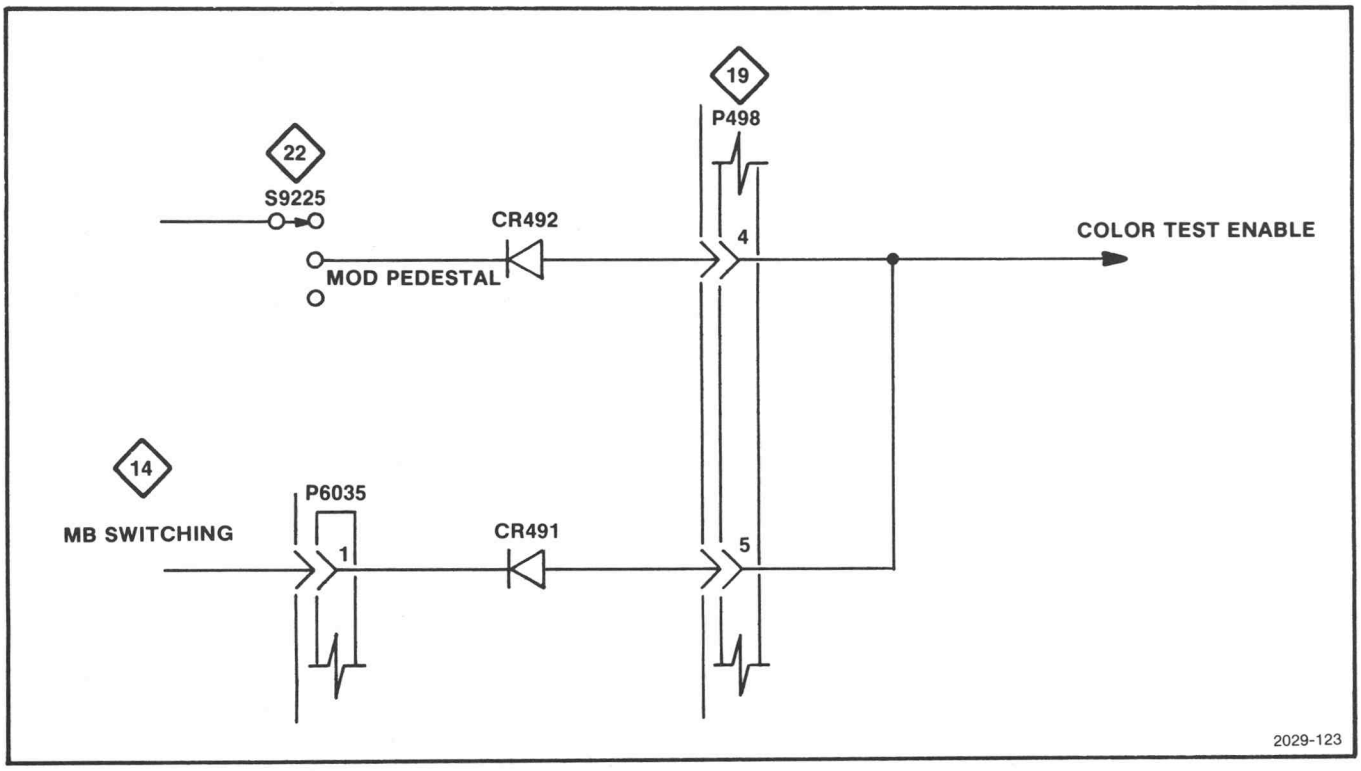


Fig. 6-3. Schematic diagram showing the addition of CR491 and CR492.

ELECTRICAL PARTS LIST

Circuit No.	Tektronix Part No.	Description	Status
R2720	321-0265-00	Resistor, 5.62 kΩ 1/8 W 1%	Change
R6119	321-0322-00	Resistor, 22.1 kΩ 1/8 W 1%	Change
R6910	321-0329-00	Resistor, 26.1 kΩ 1/8 W 1%	Change
R7461	321-0249-00	Resistor, 3.83 kΩ 1/8 W 1%	Change
R7551	321-0249-00	Resistor, 3.83 kΩ 1/8 W 1%	Change
R7553	321-0249-00	Resistor, 3.83 kΩ 1/8 W 1%	Change
R7581	321-0249-00	Resistor, 3.83 kΩ 1/8 W 1%	Change
R490	315-0332-00	Resistor, 3.3 kΩ 1/4 W 5%	Change
CR491	152-0141-02	Replaceable by 1N4152 silicon diode	Add
CR492	152-0008-00	Replaceable by T12G germanium diode	Add

MECHANICAL PARTS LIST

131-0621-00	Connector	Add
175-0529-00	1.2 feet of #26 wire	Add
333-1689-03	Panel, Front	Change
334-1914-00	Marker, Ident (Attached to P9014)	Add

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000JO	DILECTRON INC.	2669 S MYRTLE AVE	MONROVIA, CA 91016
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P O BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02111	SPECTROL ELECTRONICS CORPORATION	17070 EAST GALE AVENUE	CITY OF INDUSTRY, CA 91745
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
02777	HOPKINS ENGINEERING COMPANY	12900 FOOTHILL BLVD.	SAN FERNANDO, CA 91342
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
05397	UNION CARBIDE CORPORATION, MATERIALS SYSTEMS DIVISION	11901 MADISON AVENUE	CLEVELAND, OH 44101
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPARTMENT	NELA PARK	CLEVELAND, OH 44112
09023	CORNELL-DUBILIER ELECTRONIC DIVISION FEDERAL PACIFIC ELECTRIC CO.	2652 DALRYMPLE ST.	SANFORD, NC 27330
12697	CLAROSTAT MFG. CO., INC.	LOWER WASHINGTON STREET	DOVER, NH 03820
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
14552	MICRO SEMICONDUCTOR CORP.	2830 E FAIRVIEW ST.	SANTA ANA, CA 92704
15238	ITT SEMICONDUCTORS, A DIVISION OF INTER NATIONAL TELEPHONE AND TELEGRAPH CORP.	P.O. BOX 168, 500 BROADWAY	LAWRENCE, MA 01841
19396	ILLINOIS TOOL WORKS, INC. PAKTRON DIV.	900 FOLLIN LANE, SE	VIENNA, VA 22180
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	BRADFORD, PA 16701
24931	SPECIALITY CONNECTOR CO., INC.	2620 ENDRESS PLACE	GREENWOOD, IN 46142
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
27193	CUTLER-HAMMER, INC. SPECIALTY PRODUCTS DIVISION	4201 N. 27TH ST.	MILWAUKEE, WI 53216
28480	HEWLETT-PACKARD CO., CORPORATE HQ.	1501 PAGE MILL RD.	PALO ALTO, CA 94304
32159	WEST-CAP ARIZONA	2201 E. ELVIRA ROAD	TUCSON, AZ 85706
32293	INTERSIL, INC.	10900 N. TANTAU AVE.	CUPERTINO, CA 95014
32436	SYSCON INTERNATIONAL, INC.	205 SYCAMORE ST.	SOUTH BEND, IN 46622
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
50434	HEWLETT-PACKARD COMPANY	640 PAGE MILL ROAD	PALO ALTO, CA 94304
51642	CENTRE ENGINEERING INC.	2820 E COLLEGE AVENUE	STATE COLLEGE, PA 16801
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
59660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
75378	CTS KNIGHTS, INC.	400 REIMANN AVE.	SANDWICH, IL 60548
76493	BELL INDUSTRIES, INC., MILLER, J. W., DIV.	19070 REYES AVE., P O BOX 5825	COMPTON, CA 90224
77820	BENDIX CORP., THE, ELECTRICAL COMPONENTS DIVISION	SHERMAN AVE.	SIDNEY, NY 13838
78277	SIGMA INSTRUMENTS INC.	170 PEARL STREET	SOUTH BRAINTREE, MA 02185
78488	STACKPOLE CARBON CO.		ST. MARYS, PA 15857
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80031	ELECTRA-MIDLAND CORP., MEPCO DIV.	22 COLUMBIA ROAD	MORRISTOWN, NJ 07960
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET P. O. BOX 372	INDIANAPOLIS, IN 46206
91418	RADIO MATERIALS COMPANY, DIV. OF P.R. MALLORY AND COMPANY, INC.	4242 W BRYN MAWR	CHICAGO, IL 60646
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
95348	GORDOS CORPORATION	250 GLENWOOD AVENUE	BLOOMFIELD, NJ 07003

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A0	670-1468-01			CKT BOARD ASSY:VIT INSERTION	80009	670-1468-01
A1	670-1472-00			CKT BOARD ASSY:VERT COUNTER	80009	670-1472-00
A2	672-0669-00			CKT BOARD ASSY:HORIZ TIMING	80009	672-0669-00
A3	670-1474-00	B101000	B142289	CKT BOARD ASSY:APL STAIRCASE/NOISE	80009	670-1474-00
A3	670-1474-01	B142290		CKT BOARD ASSY:APL STAIRCASE/NOISE	80009	670-1474-01
A4	670-1469-01	B0101000	B162584	CKT BOARD ASSY:FULL FIELD AND VITS	80009	670-1469-01
A4	670-1469-07	B162585		CKT BOARD ASSY:FULL FIELD AND VITS	80009	670-1469-07
A5	670-1487-00			CKT BOARD ASSY:GENLOCK	80009	670-1487-00
A6	670-1470-01	B101000	B119999	CKT BOARD ASSY:FUNCTION GEN	80009	670-1470-01
A6	670-2039-04	B120000	B159999	CKT BOARD ASSY:FUNCTION GEN	80009	670-2039-04
A6	670-2039-14	B160000		CKT BOARD ASSY:FUNCTION GEN	80009	670-2039-14
A7	670-2042-02			CKT BOARD ASSY:OUTPUT AMP	80009	670-2042-02
A8	670-1475-02	B101000	B119999	CKT BOARD ASSY:MODULATOR	80009	670-1475-02
A8	670-1475-04	B120000		CKT BOARD ASSY:MODUALTOR	80009	670-1475-04
A9	670-1477-00	B101000	B162549	CKT BOARD ASSY:SUBCARRIER AND SYNC	80009	670-1477-00
A9	670-1477-02	B162550		CKT BOARD ASSY:SUBCARRIER AND SYNC	80009	670-1477-02
A10	670-1473-01			CKT BOARD ASSY:POWER SUPPLY	80009	670-1473-01
A11	670-2327-01	B101000	B149999	CKT BOARD ASSY:RELAY AND DELAY	80009	670-2327-01
A11	670-2327-03	B150000		CKT BOARD ASSY:RELAY AND DELAY	80009	670-2327-03
A12	670-2993-00			CKT BOARD ASSY:ALT APL	80009	670-2993-00
C22	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C24	283-0602-00			CAP.,FXD,MICA D:53PF,5%,300V	00853	D153E530J0
C28	283-0108-00			CAP.,FXD,CER DI:220PF,10%,200V	56289	272C13
C30	283-0632-00			CAP.,FXD,MICA D:87PF,1%,100V	00853	D151E870F0
C50	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C53	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C55	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C64	283-0239-00			CAP.,FXD,CER DI:0.022UF,10%,50V	72982	8121N083X7R0223K
C80	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C90	283-0641-00			CAP.,FXD,MICA D:180PF,1%,100V	00853	D151E181F0
C94	283-0641-00			CAP.,FXD,MICA D:180PF,1%,100V	00853	D151E181F0
C101	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C130	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C150	283-0005-00			CAP.,FXD,CER DI:0.01UF,+100-0%,250V	72982	8131N300Z5U0103P
C180	283-0239-00			CAP.,FXD,CER DI:0.022UF,10%,50V	72982	8121N083X7R0223K
C185	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C260	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C330	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C335	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C340	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C354	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	05397	T368C476M020AZ
C513	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C514	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	56289	5C37Z5U475M050B
C520	290-0367-00			CAP.,FXD,ELCTLT:70UF,20%,6V NONPOLARIZED	56289	30D1802
C537	281-0659-00			CAP.,FXD,CER DI:4.3PF,+/-0.25PF,500V	59660	301-000C0H0439C
C558	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C565	283-0059-00			CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z
C580	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C593	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C595	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C596	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C610	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	56289	5C37Z5U475M050B
C614	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	TDC107M020WLD
C620	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	0831522Z5D00271J
C628	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C650	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C692	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C693	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C694	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C695	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C696	283-0599-00			CAP.,FXD,MICA D:98PF,5%,500V	00853	D105F980J0
C718	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C749	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C779	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C790	290-0526-00			CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
C804	285-0622-00			CAP.,FXD,PLSTC:0.1UF,20%,100V	56289	410P10401
C822	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C844	283-0134-00			CAP.,FXD,CER DI:0.47UF,+80-20%,50V	72982	8131N087Z5U0474Z
C849	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C865	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C879	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C898	290-0526-00			CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
C910	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C915	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C918	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C919	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C927	283-0059-00			CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z
C929	283-0059-00			CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z
C959	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C968	283-0672-00			CAP.,FXD,MICA D:200PF,1%,500V	00853	D155F2010F0
C978	281-0541-00	B101000	B131949	CAP.,FXD,CER DI:6.8PF,10%,500V	59660	301-000C0H0689D
C978	281-0504-00	B131950		CAP.,FXD,CER DI:10PF,+/-1PF,500V	59660	301-055C0G0100F
C989	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	56289	5C37Z5U475M050B
C990	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C998	290-0135-00			CAP.,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C1000	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C1401	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1460	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1501	285-0835-00			CAP.,FXD,PLSTC:0.22UF,2%,100V	56289	LP66A1B224G002
C1515	281-0580-00			CAP.,FXD,CER DI:470PF,10%,500V	04222	7001-1374
C1601	283-0058-00			CAP.,FXD,CER DI:0.027UF,10%,100V	72982	8131N147X7R0273K
C1650	281-0580-00			CAP.,FXD,CER DI:470PF,10%,500V	04222	7001-1374
C1701	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1720	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1730	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C1755	283-0641-00			CAP.,FXD,MICA D:180PF,1%,100V	00853	D151E181F0
C1760	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C1770	283-0593-00			CAP.,FXD,MICA D:0.01UF,1%,100V	00853	D301F103F0
C1780	285-0626-00			CAP.,FXD,PLSTC:0.0015UF,10%,100V	56289	410P102
C1798	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C1895	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C1902	283-0622-00			CAP.,FXD,MICA D:450PF,1%,300V	00853	D153F451F0
C1930	281-0629-00			CAP.,FXD,CER DI:33PF,5%,600V	04222	7027-C0G-330J
C1940	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C1950	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C1995	281-0562-00			CAP.,FXD,CER DI:39PF,10%,500V	59660	301-000U2J0390K
C1998	283-0593-00			CAP.,FXD,MICA D:0.01UF,1%,100V	00853	D301F103F0
C2030	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	TDC107M020WLD
C2708	283-0119-00			CAP.,FXD,CER DI:2200PF,5%,200V	59660	855-536Y5E0222J
C2730	283-0597-00			CAP.,FXD,MICA D:470PF,10%,300V	00853	D153E471K0
C2936	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C2958	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C3001	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1

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C3011	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3021	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3083	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C3121	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C3201	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3221	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3231	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C3241	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3242	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3251	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C3281	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C3283	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3331	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3333	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C3341	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3361	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C3381	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C3383	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C3421	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C3431	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3441	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C3443	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C3461	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C3467	283-0637-00			CAP.,FXD,MICA D:20PF,2.5%,100V	00853	D151E200D0
C3470	281-0131-00			CAP.,VAR,AIR DI:2.4-24.5PF,250V	74970	189-0509-075
C3473	283-0638-00			CAP.,FXD,MICA D:130PF,1%,100V	00853	D151F131F0
C3491	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C3551	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C3565	281-0131-00			CAP.,VAR,AIR DI:2.4-24.5PF,250V	74970	189-0509-075
C3601	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3651	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C3711	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C3780	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C3881	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C4188	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4271	283-0268-00	XB162585		CAP.,FXD,CER DI:0.015UF,10%,50V	56289	1C20X7R153K050B
C4460	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C4620	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4662	283-0620-00			CAP.,FXD,MICA D:470PF,1%,300V	00853	D153F471F0
C4721	283-0028-00			CAP.,FXD,CER DI:0.0022UF,20%,50V	56289	19C606
C5022	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C5040	283-0111-00	B101000	B121389	CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5040	283-0167-00	B121390		CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C5042	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5048	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C5049	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5050	283-0256-00			CAP.,FXD,CER DI:130PF,5%,100V	51642	200-100N1500131J
C5065	290-0114-00			CAP.,FXD,ELCTLT:47UF,20%,6V	56289	150D476X0006B2
C5070	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5085	290-0134-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	150D226X0015B2
C5120	283-0256-00			CAP.,FXD,CER DI:130PF,5%,100V	51642	200-100N1500131J
C5141	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5170	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5201	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5210	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5225	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5245	283-0192-00	B101000	B162575	CAP.,FXD,CER DI:0.47UF,+80-20%,3V	000JO	RT3474Z-H

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C5245	283-0203-00	B162576		CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C5258	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C5270	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C5291	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5330	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	91418	MX0104Z1205R5
C5335	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5342	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5362	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5410	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	91418	MX0104Z1205R5
C5435	283-0192-00	B101000	B162575	CAP.,FXD,CER DI:0.47UF,+80-20%,3V	000J0	RT3474Z-H
C5435	283-0203-00	B162576		CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C5450	283-0104-00			CAP.,FXD,CER DI:2000PF,5%,500V	72982	811-565B202J
C5468	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5518	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5540	283-0104-00			CAP.,FXD,CER DI:2000PF,5%,500V	72982	811-565B202J
C5568	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5570	283-0017-00	B101000	B162499	CAP.,FXD,CER DI:1UF,+80-20%,3V	000J0	RT31052-H
C5570	283-0059-00	B162500		CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z
C5572	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5615	283-0618-00			CAP.,FXD,MICA D:130PF,2%,400V	00853	D155F131G0
C5620	283-0618-00			CAP.,FXD,MICA D:130PF,2%,400V	00853	D155F131G0
C5622	283-0004-00	B101000	B131949	CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5622	283-0081-00	B131950		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C5648	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5660	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5665	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5670	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5715	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5718	281-0503-00			CAP.,FXD,CER DI:8PF,+/-0.5PF,500V	59660	301-000C0H0809D
C5720	283-0004-00	B101000	B131949	CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5720	283-0081-00	B131950		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C5750	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5775	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5788	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	59660	8151B202Y5S0103M
C5799	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	59660	8151B202Y5S0103M
C5810	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5820	283-0651-00			CAP.,FXD,MICA D:430PF,1%,500V	00853	D155F431F0
C5824	283-0119-00			CAP.,FXD,CER DI:2200PF,5%,200V	59660	855-536Y5E0222J
C5826	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5834	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5840	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C5850	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5862	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C6042	281-0504-00	B101000	B119999	CAP.,FXD,CER DI:10PF,+/-1PF,500V	59660	301-055C0G0100F
C6042	281-0613-00	B120000		CAP.,FXD,CER DI:10PF,+/-1PF,200V	59660	374001C0G100F
C6047	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C6051	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0020HA1
C6071	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C6078	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C6108	283-0000-00	XB120000		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6362	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C6372	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C6382	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C6486	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C6508	283-0648-00	B101000	B119999	CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C6508	281-0541-00	B120000		CAP.,FXD,CER DI:6.8PF,10%,500V	59660	301-000C0H0689D
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C6533	283-0648-00	B101000	B119999	CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C6533	281-0509-00	B120000		CAP.,FXD,CER DI:15PF,+/-1.5PF,500V	59660	301-000C0G0150K
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C6562	283-0601-00	B101000	B119999	CAP.,FXD,MICA D:22PF,10%,300V	00853	D153C220K0
C6562	281-0510-00	B120000		CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	59660	301-000C0G0220M
C6606	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C6608	283-0000-00	XB120000		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6610	283-0000-00	XB120000		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6614	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C6663	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C6665	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C6682	283-0003-00	B101000	B119999	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C6682	283-0081-00	B120000	B162612	CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C6682	283-0178-00	B162613		CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C6693	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C6712	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C6736	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C6740	281-0611-00	XB120000		CAP.,FXD,CER DI:2.7PF,+/-0.25PF,200V	59660	374-018C0J0279C
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C6748	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C6763	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C6788	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C6866	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6887	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6979	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C7061	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C7212	283-0634-00			CAP.,FXD,MICA D:65PF,1%,100V	00853	D151E650F0
C7301	281-0205-00			CAP.,VAR,PLSTC:5.5-65PF,100V	80031	2810C5R565QJ02F0
C7303	283-0625-00			CAP.,FXD,MICA D:220PF,1%,500V	00853	D105F221F0
C7305	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C7307	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C7309	283-0636-00			CAP.,FXD,MICA D:36PF,1.4%,100V	00853	D155E360G0
C7310	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C7311	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C7312	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C7383	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C7401	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C7403	283-0603-00			CAP.,FXD,MICA D:113PF,2%,300V	00853	D153F1130G0
C7431	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C7451	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C7461	281-0166-00			CAP.,VAR,AIR DI:1.9-15.7PF,250V	74970	187-0109-055
C7463	281-0166-00			CAP.,VAR,AIR DI:1.9-15.7PF,250V	74970	187-0109-055
C7481	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C7501	283-0636-00			CAP.,FXD,MICA D:36PF,1.4%,100V	00853	D155E360G0
C7503	283-0674-00			CAP.,FXD,MICA D:85PF,1%,500V	00853	D155F850F0
C7505	283-0663-00			CAP.,FXD,MICA D:16.8PF,+/-0.5PF,500V	00853	D155C16R8D0
C7507	283-0600-00			CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0
C7508	283-0639-00			CAP.,FXD,MICA D:56PF,1%,100V	00853	D151E560F0
C7509	283-0638-00			CAP.,FXD,MICA D:130PF,1%,100V	00853	D151F131F0
C7533	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C7551	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-518-Z5D0102J
C7555	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C7601	283-0601-00			CAP.,FXD,MICA D:22PF,10%,300V	00853	D153C220K0
C7603	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C7671	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C7681	290-0367-00			CAP.,FXD,ELCTLT:70UF,20%,6V NONPOLARIZED	56289	30D1802
C7711	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C7731	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C7781	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C7783	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	05397	T368C476M020AZ
C7791	281-0661-00			CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V	04222	7001-1268
C7801	281-0626-00			CAP.,FXD,CER DI:3.3PF,1%,500V	59660	301-000C0J0339B
C7803	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C7861	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C7883	283-0111-00	B101000	B131949	CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C7883	283-0177-00	B131950		CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C7891	283-0633-00			CAP.,FXD,MICA D:77PF,1%,100V	00853	D151E770F0
C7901	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C7903	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C7932	283-0164-00			CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C7951	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C8015	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C8037	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C8039	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8050	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8075	283-0004-00	B101000	B131949	CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8075	283-0081-00	B131950		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C8110	283-0238-00			CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N075X7R0103K
C8120	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C8135	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C8180	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C8185	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C8188	281-0512-00	XB120000		CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	59660	308-000C0G0270K
C8189	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8190	283-0687-00			CAP.,FXD,MICA D:560PF,2%,300V	00853	D153F561G0
C8240	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8250	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8264	283-0203-00			CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C8282	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8290	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8295	283-0113-00			CAP.,FXD,CER DI:56PF,1%,500V	59660	0851560C0G0560F
C8330	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-518-Z5D0102J
C8350	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8375	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8410	283-0004-00	B101000	B131949	CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8410	283-0081-00	B131950		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C8460	283-0600-00			CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0
C8470	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8490	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C8530	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C8535	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C8555	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8558	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8572	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8580	283-0638-00			CAP.,FXD,MICA D:130PF,1%,100V	00853	D151F131F0
C8590	283-0601-00			CAP.,FXD,MICA D:22PF,10%,300V	00853	D153C220K0
C8610	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C8635	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C8650	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8668	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8687	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8689	281-0064-00			CAP.,VAR,PLSTC:0.25-1.5PF,600V	74970	273-0001-101
C8742	283-0636-00	B101000	B119999X	CAP.,FXD,MICA D:36PF,1.4%,100V	00853	D155E360G0
C8845	283-0176-00			CAP.,FXD,CER DI:0.0022UF,20%,50V	72982	8121B058X7R0222M

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C8959	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C8965	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C8996	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C9011	290-0334-00			CAP.,FXD,ELCTLT:1250UF,+75-10%,50V	56289	D46468
C9042	290-0321-00			CAP.,FXD,ELCTLT:11000UF,+100-10%,15V	90201	20-24012
C9061	290-0086-00			CAP.,FXD,ELCTLT:2000UF,+150-10%,35OV	56289	D27740
C9083	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9086	283-0220-00	XB150000		CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075X7R0103M
C9090	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C9091	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C9092	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9094	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9095	281-0625-00			CAP.,FXD,CER DI:35PF,5%,500V	59660	308-000C0G0350J
C9215	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C9218	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9802	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	19396	DU490B103J
C9810	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9824	290-0296-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	150D107X0020S2
C9830	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	19396	DU490B103J
C9832	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9840	290-0135-00			CAP.,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C9850	290-0135-00			CAP.,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C9852	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9854	281-0549-00			CAP.,FXD,CER DI:68PF,10%,500V	59660	301-000U2J0680K
C9856	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	19396	DU490B103J
CR7	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR35	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR250	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR329	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR338	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR584	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR585	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR588	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR651	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR664	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR720	152-0269-00	B101000	B142009	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR720	152-0269-01	B142010		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR740	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR796	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR924	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR944	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR992	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1301	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1420	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1510	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1544	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1720	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1740	152-0269-00	B101000	B142009	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR1740	152-0269-01	B142010		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR1795	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1830	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1930	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3351	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3411	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3413	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

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CR3451	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3531	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3533	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3551	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3641	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3651	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3653	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3711	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR3721	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3723	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3725	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3811	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR3821	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3823	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3881	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3911	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR3913	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3921	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3923	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR4570	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR4572	152-0141-02	B101000	B111200X	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR4784	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5010	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5015	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5030	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5035	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5255	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5260	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5265	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5270	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5331	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
CR5335	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5340	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5365	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5370	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5380	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5411	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
CR5415	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5420	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5570	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5571	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5572	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5674	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5676	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5835	152-0269-00	B101000	B142009	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR5835	152-0269-01	B142010		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR5855	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5865	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5877	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5878	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5885	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5887	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5940	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6013	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6017	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6019	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6022	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

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CR6028	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6033	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6037	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6048	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6112	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6114	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6118	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6122	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6128	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6132	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6136	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6182	152-0125-00			SEMICOND DEVICE:TUNNEL,15PF,4.7MA	03508	STD704
CR6306	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6306	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6308	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6308	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6316	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6316	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6318	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6318	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6322	152-0442-00	B101000	B159999	SEMICOND DEVICE:SILICON,MATCHED PAIR (CR6322 MATCHED PAIR WITH CR6348)	80009	152-0442-00
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CR6322	152-0748-00	B160000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6328	152-0442-00	B101000	B159999	SEMICOND DEVICE:SILICON,MATCHED PAIR (CR6328 MATCHED PAIR WITH CR6404)	80009	152-0442-00
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CR6328	152-0748-00	B160000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6331	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6331	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6335	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6335	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6338	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6338	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6344	152-0141-02	B101000	B119999	SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6344	152-0153-00	B120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6348	152-0442-00	B101000	B159999	SEMICOND DEVICE:SILICON,MATCHED PAIR (CR6348 MATCHED PAIR WITH CR6322)	80009	152-0442-00
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CR6348	152-0748-00	B160000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6376	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
CR6404	152-0442-00	B101000	B159999	SEMICOND DEVICE:SILICON,MATCHED PAIR (CR6404 MATCHED PAIR WITH CR6328)	80009	152-0442-00
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CR6404	152-0748-00	B160000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6464	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6466	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6469	152-0457-00			SEMICOND DEVICE:SILICON,25V	28480	5082-2068
CR6588	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6603	152-0141-02	XB120000		SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6624	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6634A	B153-0029-00	B101000	B119999	SEMICOND DVC SE:SILICON,2 MATCHED	80009	153-0029-00
CR6634	152-0141-02	B120000		SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6703	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6705	152-0153-00	XB120000		SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6709	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6789	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6885	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6913	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6915	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6918	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR6920	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6923	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6925	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6966	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6987	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6988	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7008	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7041	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7091	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7093	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7095	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7190	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7215	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7218	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7341	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7343	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7345	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7347	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7581	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7711	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7951	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8095	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8098	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8166	152-0269-00	B101000	B142009	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR8166	152-0269-01	B142010		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR8168	152-0269-00	B101000	B142009	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR8168	152-0269-01	B142010		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR8188	152-0269-00	B101000	B142009	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR8188	152-0269-01	B142010		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR8220	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8350	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8352	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8375	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8378	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8620	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8621	152-0141-02	XB111200		SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8710	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8810	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8812	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8816	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8818	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8842	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8912	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8914	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR9081	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR9085	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR9089	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR9802	152-0198-00			SEMICOND DEVICE:SILICON,200V,3A	03508	1N5624
CR9804	152-0198-00			SEMICOND DEVICE:SILICON,200V,3A	03508	1N5624
CR9830	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9830	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9832	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9832	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9834	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9834	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9836	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9836	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012

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CR9870	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9870	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9872	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9872	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9874	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9874	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9876	152-0066-00	B101000	B152329	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9876	152-0066-01	B152330		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
DS9201	150-0018-00	B101000	B162624	LAMP,INCAND:6.3V	08806	12
DS9201	150-0045-00	B162625		LAMP,INCAND:5V,0.06A	08806	685
DS9202	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9210	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9211	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9220	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9221	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9222	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
F9201	159-0042-00			FUSE,CARTRIDGE:3AG,0.75A,250V,FAST-BLOW	71400	AGC 3/4
F9202	159-0025-00			FUSE,CARTRIDGE:3AG,0.5A,250V,FAST-BLOW	71400	AGC 1/2
FL9201	119-0095-06	B101000	B131859	FILTER,RAD INTE:400 HZ,250 VAC	56289	JN10-2319A1
FL9201	119-0389-00	B131860		FILTER,RAD INTE:115/230V,3A	02777	F11935-3
J9001	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9002	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9003	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9004	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9005	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9006	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9007	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9008	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9009	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9010	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9011	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9014	131-0324-00			CONNECTOR,RCPT,:24 PIN,FEMALE	71785	222-42-24-060
J9210	131-0106-02			CONNECTOR,RCPT,:BNC	24931	28JR178-1
J9240	131-0106-02			CONNECTOR,RCPT,:BNC	24931	28JR178-1
J9250	131-0106-02			CONNECTOR,RCPT,:BNC	24931	28JR178-1
K390	148-0064-00			RELAY,REED:SPST	95348	CB-831A-26
K9080	148-0086-00			RELAY,REED:SPDT,COIL 5V,150 OHM	78277	191TE1C15G
K9082	148-0034-00	B101000	B142099	RELAY,ARMATURE:DPDT,15VDC,600 OHM	80009	148-0034-00
K9082	148-0107-04	B142100		RELAY,ARMATURE:W/8 PIN HEADER	80009	148-0107-04
K9089	148-0034-00	B101000	B142099	RELAY,ARMATURE:DPDT,15VDC,600 OHM	80009	148-0034-00
K9089	148-0107-04	B142100		RELAY,ARMATURE:W/8 PIN HEADER	80009	148-0107-04
L20	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L30	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L94	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L520	276-0507-00			SHIELDING BEAD,:FERRITE	78488	57-3443
L720	108-0226-00			COIL,RF:100UH	76493	DWG B4257
L912	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L1670	114-0308-00			COIL,RF:2.9-6.5UH	80009	114-0308-00
L1770	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L1850	108-0174-00			COIL,RF:245UH	80009	108-0174-00
L3070	108-0395-00			COIL,RF:64UH	80009	108-0395-00
L5055	108-0317-00			COIL,RF:FIXED,15UH	32159	71501M
L5101	114-0303-00			COIL,RF:6.5-23UH,CORE 276-0506-00	80009	114-0303-00
L5242	108-0174-00			COIL,RF:245UH	80009	108-0174-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
L5320	108-0174-00			COIL,RF:245UH	80009	108-0174-00
L5601	108-0317-00			COIL,RF:FIXED,15UH	32159	71501M
L5830	108-0231-00			COIL,RF:4.5UH	80009	108-0231-00
L6482	276-0507-00			SHIELDING BEAD,:FERRITE	78488	57-3443
L6852	276-0507-00	B101000	B119999	SHIELDING BEAD,:FERRITE	78488	57-3443
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L6852	SELECTED	B120000				
L7110	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7301	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L7311	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L7401	114-0278-00			COIL,RF:4.6-16.7UH,CORE 276-0568-00	80009	114-0278-00
L7411	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7501	114-0278-00			COIL,RF:4.6-16.7UH,CORE 276-0568-00	80009	114-0278-00
L7511	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7601	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L7611	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7631	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L8010	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L8030	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L8050	114-0254-00			COIL,RF:30-60UH,CORE NOT REPLACEABLE	80009	114-0254-00
L8150	114-0310-00			COIL,RF:22-80UH	80009	114-0310-00
L8190	114-0177-00			COIL,RF:280-650UH,SHIELDED	32436	5E-003-4
L8390	114-0177-00			COIL,RF:280-650UH,SHIELDED	32436	5E-003-4
L8580	114-0281-00			COIL,RF:35-70UH,CORE 276-0540-00	80009	114-0281-00
L8590	114-0281-00			COIL,RF:35-70UH,CORE 276-0540-00	80009	114-0281-00
L8640	114-0219-00			COIL,RF:VARIABLE,43-130UH	80009	114-0219-00
L8680	120-0524-00			XFMR,TOROID:12 TURNS QUADFILAR	80009	120-0524-00
Q10	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q30	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q40	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q50	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q55	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q60	151-0225-00			TRANSISTOR:SILICON,NPN	07263	S39291
Q70	151-0225-00			TRANSISTOR:SILICON,NPN	07263	S39291
Q80	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q90	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q160	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q230	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q240	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q250	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q260	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q319	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q350	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q355	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q380	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q510	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q520	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q540	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q550	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q560	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q565	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q570	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q580	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q620	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q630	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q640	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q658	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q680	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q730	151-0104-00			TRANSISTOR:SILICON,NPN	07263	SP8481
Q740	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q750	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q760	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q790	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q820	151-1039-00			TRANSISTOR:SILICON,JFE,P-CHANNEL	80009	151-1039-00
Q840	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q860	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q880	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q885	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q900	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q905	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q920	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q930	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q950	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q960	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q965	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q980	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q990	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q1401	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1411	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1421	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1501	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1601	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1631	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1691	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1701	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1721	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q1731	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1741	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1791	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1801	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1811	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1901	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1911	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1921	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1991	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q2710	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3040	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3050	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3060	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3070	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3110	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3130	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q3210	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3240	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q3250	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3300	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3360	151-0223-00	B101000	B141926	TRANSISTOR:SILICON,NPN	04713	SPS8026
Q3360	151-0127-00	B141927		TRANSISTOR:SILICON,NPN	07263	S006075
Q3370	151-0223-00	B101000	B141926	TRANSISTOR:SILICON,NPN	04713	SPS8026
Q3370	151-0127-00	B141927		TRANSISTOR:SILICON,NPN	07263	S006075
Q3420	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3430	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q3440	151-1039-00			TRANSISTOR:SILICON,JFE,P-CHANNEL	80009	151-1039-00
Q3450	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q3470	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3510	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3520	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3530	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q3540	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q3540	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q3545	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q3580	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3600	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3610	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3645	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q3720	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3780	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q3820	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3825	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3880	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3890	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3920	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q4180	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4190	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4280	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4290	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4380	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4390	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4480	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4490	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5021	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5031	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5041	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5051	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5091	151-0224-00			TRANSISTOR:SILICON,NPN	07263	SA24850
Q5131	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5141	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q5151	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5161	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5171	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5181	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5191	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q5231	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5241	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	04713	SPS8802-1
Q5251	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5261	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5271	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5281	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5291	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5311	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	04713	SPS8802-1
Q5331	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5341	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5351	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5361	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5371	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5381	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5391	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5431	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5441	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5451	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5461	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q5471	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5481	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5491	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5511	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5521	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5551	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5561	151-0224-00			TRANSISTOR:SILICON,NPN	07263	SA24850
Q5571	151-0224-00			TRANSISTOR:SILICON,NPN	07263	SA24850
Q5581	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q5591	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S006075
Q5661	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5681	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S006075
Q5721	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5731	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5741	151-0190-00	B101000	B142002	TRANSISTOR:SILICON,NPN	07263	S032677
Q5741	151-0367-00	B142003		TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	01295	SKA6516
Q5751	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5761	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5771	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5781	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5791	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5821	151-0190-00	B101000	B142002	TRANSISTOR:SILICON,NPN	07263	S032677
Q5821	151-0367-00	B142003		TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	01295	SKA6516
Q5831	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5841	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5851	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5861	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5871	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5881	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5891	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5931	151-0207-00			TRANSISTOR:SILICON,NPN	03508	X32D6191
Q5941	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5951	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q5961	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5971	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5981	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5991	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q6010	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6068	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6091	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6095	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6103	151-0223-00	B101000	B119999	TRANSISTOR:SILICON,NPN	04713	SPS8026
Q6103	151-0127-00	B120000		TRANSISTOR:SILICON,NPN	07263	S006075
Q6106	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6149	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6162	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6164	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q6192	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6198	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q6212	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6222	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6228	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6233	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6244	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6255	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6262	151-0341-00			TRANSISTOR:SILICON,NPN	07263	S040065
Q6266	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q6298	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6392	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6398	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q6452	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6478	151-0133-00	B101000	B162623	TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q6478	151-0133-03	B162624		TRANSISTOR:2N3251,SCREENED	80009	151-0133-03
Q6482	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q6494	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6496	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6569	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6593	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6624	151-0361-00			TRANSISTOR:SILICON,NPN,DUAL	80009	151-0361-00
Q6653	151-0236-00			TRANSISTOR:SILICON,NPN	32293	ITS1074
Q6672	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q6715	151-0192-00	XB120000		TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6758	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q6772	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q6786	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6803	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6813	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6824	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6828	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6852	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6858	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q6877	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q7001	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7001	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7191	151-0325-00	B101000	B162510	TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
Q7191	151-0325-01	B162511		TRANSISTOR:SILICON,PNP,SEL	80009	151-0325-01
Q7221	151-0139-00			TRANSISTOR:SILICON,NPN	80009	151-0139-00
Q7241	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7251	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7321	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7331	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7431	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q7443	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7481	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7481	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7531	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7551	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7551	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7571	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7571	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7630	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7651	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7651	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7711	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7763	151-0236-00			TRANSISTOR:SILICON,NPN	32293	ITS1074
Q7771	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q7781	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q7783	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q7811	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q7911	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q7921	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q7961	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q7971	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7981	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K

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Q8020	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8090	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8110	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8120	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8130	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8140	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8145	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8160	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q8170	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q8350	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8355	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q8355	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q8360	151-0269-00	B101000	B162613	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q8360	151-0269-01	B162614		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q8370	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8430	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q8455	151-0188-00	B101000	B119999X	TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q8460	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8530	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q8540	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q8560	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8570	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8620	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8630	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8670	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8720	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8820	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8825	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8850	151-0236-00			TRANSISTOR:SILICON,NPN	32293	ITS1074
Q8860	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	07263	SP12141
Q8920	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8950	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q8955	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9035	151-0140-00			TRANSISTOR:SILICON,NPN	02735	36568
Q9055	151-0140-00			TRANSISTOR:SILICON,NPN	02735	36568
Q9083	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9084	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9085	151-0140-00			TRANSISTOR:SILICON,NPN	02735	36568
Q9800	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q9802	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9804	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9806	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9830	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q9832	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9834	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9836	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9850	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q9852	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9854	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9856	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
R3	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R7	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R12	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R30	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R32	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F

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R36	321-0105-00			RES.,FXD,FILM:121 OHM,1%,0.125W	91637	MFF1816G121R0F
R40	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R45	321-0275-00			RES.,FXD,FILM:7.15K OHM,1%,0.125W	91637	MFF1816G71500F
R50	322-0085-00			RES.,FXD,FILM:75 OHM,1%,0.25W	75042	CEBT0-75R00F
R52	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R54	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R56	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R57	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R59	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R60	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0.125W	91637	MFF1816G17401F
R62	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R64	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R66	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R70	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R74	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R84	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R86	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R134	321-0210-00	B101000	B162449	RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R134	321-0215-00	B162450		RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
R138	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R140	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R150	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	32997	3329P-L58-501
R151	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R152	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R155	321-0293-00			RES.,FXD,FILM:11K OHM,1%,0.125W	91637	MFF1816G11001F
R158	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R160	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R162	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R190	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R235	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	91637	MFF1816G36500F
R240	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R245	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R250	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R255	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R260	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R280	322-0085-00			RES.,FXD,FILM:75 OHM,1%,0.25W	75042	CEBT0-75R00F
R285	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R289	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R301	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R329	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R335	321-0314-00			RES.,FXD,FILM:18.2K OHM,1%,0.125W	91637	MFF1816G18201F
R336	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R337	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R339	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R350	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R352	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R354	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R356	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R380	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R385	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R388	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R501	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R504	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	91637	MFF1816G665R0F
R505	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	32997	3329P-L58-501
R512	321-0157-00			RES.,FXD,FILM:422 OHM,1%,0.125W	91637	MFF1816G422R0F
R520	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R526	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F

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R528	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R530	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R550	321-0152-00			RES.,FXD,FILM:374 OHM,1%,0.125W	91637	MFF1816G374R0F
R552	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R553	321-0296-00			RES.,FXD,FILM:11.8K OHM,1%,0.125W	91637	MFF1816G11801F
R555	321-0085-01			RES.,FXD,FILM:75 OHM,0.5%,0.125W	24546	NA55D75R0D
R562	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R566	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	91637	MFF1816G31600F
R576	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R583	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R586	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R587	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R588	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R592	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R594	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R596	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R597	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R598	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R612	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R618	315-0106-00			RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R619	301-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.50W	01121	EB6815
R625	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R627	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R630	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R642	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R654	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R658	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R659	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R662	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R666	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R668	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R670	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R674	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R676	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R677	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R684	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R690	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R692	321-0085-01			RES.,FXD,FILM:75 OHM,0.5%,0.125W	24546	NA55D75R0D
R693	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R694	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R698	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R707	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R710	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R711	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R713	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R714	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R716	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R718	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R720	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R735	311-1272-00			RES.,VAR,NONWIR:100K OHM,10%,0.50W	32997	3329P-L58-104
R740	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R748	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R749	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R750	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R754	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R756	321-0178-00			RES.,FXD,FILM:698 OHM,1%,0.125W	91637	MFF1816G698R0F
R757	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F

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R759	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R765	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R766	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R770	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R772	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R773	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R774	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R775	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R785	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R786	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R790	301-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.50W	01121	EB8215
R797	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R806	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R808	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R817	321-0372-00			RES.,FXD,FILM:73.2K OHM,1%,0.125W	91637	MFF1816G73201F
R819	321-0374-00			RES.,FXD,FILM:76.8K OHM,1%,0.125W	91637	MFF1816G76801F
R820	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R821	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R840	321-0238-00			RES.,FXD,FILM:2.94K OHM,1%,0.125W	91637	MFF1816G29400F
R842	321-0165-00			RES.,FXD,FILM:511 OHM,1%,0.125W	91637	MFF1816G511R0F
R843	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R845	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R847	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R848	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R849	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R850	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R854	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R856	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R862	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R863	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R868	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R870	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R872	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R874	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R876	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R883	301-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.50W	01121	EB1225
R888	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R890	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R893	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R895	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	32997	3329P-L58-501
R896	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R897	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R898	301-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.50W	01121	EB8215
R906	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R908	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R910	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R912	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R915	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R917	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R919	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R920	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R926	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R928	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R940	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R942	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R943	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R950	321-0178-00			RES.,FXD,FILM:698 OHM,1%,0.125W	91637	MFF1816G698R0F

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R952	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R954	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R955	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R957	321-0238-00			RES.,FXD,FILM:2.94K OHM,1%,0.125W	91637	MFF1816G29400F
R958	321-0165-00			RES.,FXD,FILM:511 OHM,1%,0.125W	91637	MFF1816G511R0F
R959	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R965	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R966	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R969	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R970	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R971	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R972	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R973	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R975	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R976	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R977	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R978	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R979	301-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.50W	01121	EB1225
R985	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R993	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R994	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R995	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R996	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R997	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R1000	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1098	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1350	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1365	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1395	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1400	315-0185-00			RES.,FXD,CMPSN:1.8M OHM,5%,0.25W	01121	CB1855
R1401	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1420	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1430	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1501	315-0275-00			RES.,FXD,CMPSN:2.7M OHM,5%,0.25W	01121	CB2755
R1502	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1520	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1530	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1601	321-0255-00			RES.,FXD,FILM:4.42K OHM,1%,0.125W	91637	MFF1816G44200F
R1602	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	91637	MFF1816G63400F
R1630	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R1631	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1632	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R1650	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1655	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R1695	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R1701	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R1710	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1715	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1720	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1721	315-0124-00			RES.,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R1725	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1730	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R1732	315-0155-00			RES.,FXD,CMPSN:1.5M OHM,5%,0.25W	01121	CB1555
R1735	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1740	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1750	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R1755	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225

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R1760	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1791	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1793	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1795	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R1798	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R1799	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R1805	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R1810	321-0255-00			RES.,FXD,FILM:4.42K OHM,1%,0.125W	91637	MFF1816G44200F
R1820	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	91637	MFF1816G63400F
R1830	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1835	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R1840	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1890	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1893	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0.125W	91637	MFF1816G17401F
R1900	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R1903	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R1930	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R1935	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1940	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1950	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1955	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1988	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R1990	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1991	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1998	315-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R2701	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2703	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W	91637	MFF1816G66500F
R2705	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2715	311-0633-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	82-30-1
R2720	321-0299-00			RES.,FXD,FILM:12.7K OHM,1%,0.125W	91637	MFF1816G12701F
R2882	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2910	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2915	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2918	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R2920	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2922	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2932	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2934	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2970	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2980	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3001	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R3003	315-0272-00	B101000	B142289	RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3003	315-0152-00	B142290		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3005	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3007	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3013	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R3021	321-0082-00			RES.,FXD,FILM:69.8 OHM,1%,0.125W	91637	MFF1816G69R80F
R3031	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R3041	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3043	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3051	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3061	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3071	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3081	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3083	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3121	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R3123	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525

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R3125	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3126	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3141	315-0180-00			RES.,FXD,CMPSN:18 OHM,5%,0.25W	01121	CB1805
R3151	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3153	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3161	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3163	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3165	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3171	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R3181	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3183	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R3185	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3186	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R3211	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3221	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R3223	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3225	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3227	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R3241	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3260	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	32997	3386F-T04-102
R3270	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R3271	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R3281	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3283	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3285	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3311	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R3321	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3323	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3325	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R3331	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R3335	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R3337	321-0352-00			RES.,FXD,FILM:45.3K OHM,1%,0.125W	91637	MFF1816G45301F
R3341	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R3343	321-0081-00			RES.,FXD,FILM:68.1 OHM,1%,0.125W	91637	MFF1816G68R10F
R3345	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3353	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3371	321-0081-00			RES.,FXD,FILM:68.1 OHM,1%,0.125W	91637	MFF1816G68R10F
R3373	315-0132-00			RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R3381	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R3383	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3385	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3410	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R3411	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3420	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R3431	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3450	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3451	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R3453	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R3481	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3491	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3511	321-0216-00			RES.,FXD,FILM:1.74K OHM,1%,0.125W	91637	MFF1816G17400F
R3513	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R3515	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R3517	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3521	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3523	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3531	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635

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R3541	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R3553	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3555	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R3557	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R3581	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3583	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3585	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R3610	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3616	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R3621	321-0353-00			RES.,FXD,FILM:46.4K OHM,1%,0.125W	91637	MFF1816G46401F
R3623	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3625	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3641	321-0297-00			RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
R3661	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3663	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3671	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3711	321-0262-00			RES.,FXD,FILM:5.23K OHM,1%,0.125W	91637	MFF1816G52300F
R3713	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3791	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R3793	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R3795	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3811	321-0266-00			RES.,FXD,FILM:5.76K OHM,1%,0.125W	91637	MFF1816G57600F
R3813	321-0358-00			RES.,FXD,FILM:52.3K OHM,1%,0.125W	91637	MFF1816G52301F
R3814	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3840	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3890	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R3911	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3913	321-0262-00			RES.,FXD,FILM:5.23K OHM,1%,0.125W	91637	MFF1816G52300F
R3961	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3993	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3995	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3997	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4174	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4184	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4188	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4250	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4254	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4260	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4270	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4271	315-0201-00	XB162585		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R4272	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4280	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4290	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4370	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4390	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4468	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4470	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4484	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4486	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4488	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R4550	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4571	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4622	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4642	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4644	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4662	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R4728	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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R4768	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4772	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4776	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4780	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4786	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4920	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4922	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4960	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4996	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5018	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5020	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5022	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R5030	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R5033	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5042	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5044	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R5046	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5049	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R5050	315-0430-00			RES.,FXD,CMPSN:43 OHM,5%,0.25W	01121	CB4305
R5052	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5055	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R5060	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R5065	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R5070	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R5074	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5075	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R5076	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5080	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R5081	315-0914-00			RES.,FXD,CMPSN:910K OHM,5%,0.25W	01121	CB9145
R5089	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5115	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R5131	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5135	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R5138	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R5140	315-0433-00	B101000	B131949	RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R5140	315-0273-00	B131950		RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R5155	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R5157	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5160	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816G32401F
R5162	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R5165	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5175	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5178	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R5185	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R5193	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R5215	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5218	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R5220	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5240	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5245	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5247	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R5249	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5260	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5265	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R5268	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R5269	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5270	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525

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R5285	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5315	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5325	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R5345	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5348	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5350	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R5355	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R5357	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R5360	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5362	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5370	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5375	315-0623-00			RES.,FXD,CMPSN:62K OHM,5%,0.25W	01121	CB6235
R5380	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5385	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5398	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5401	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R5420	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5425	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5430	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R5440	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5442	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5455	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R5461	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5465	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5470	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5472	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5474	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5476	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5490	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5520	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
R5525	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R5530	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5540	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R5542	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R5545	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5550	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5560	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5562	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5570	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5575	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R5580	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5582	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R5584	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5590	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5595	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5610	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R5618	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5635	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5640	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5642	315-0363-00			RES.,FXD,CMPSN:36K OHM,5%,0.25W	01121	CB3635
R5665	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5670	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5672	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5685	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5701	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R5710	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5720	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R5722	315-0433-00			RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R5735	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R5740	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R5742	315-0754-00			RES.,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
R5744	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5746	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R5750	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R5755	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5758	316-0825-00			RES.,FXD,CMPSN:8.2M OHM,10%,0.25W	01121	CB8251
R5760	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5770	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5772	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R5775	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5780	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R5781	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R5784	321-0371-00			RES.,FXD,FILM:71.5K OHM,1%,0.125W	91637	MFF1816G71501F
R5785	321-0331-00			RES.,FXD,FILM:27.4K OHM,1%,0.125W	91637	MFF1816G27401F
R5788	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R5790	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5792	321-0371-00			RES.,FXD,FILM:71.5K OHM,1%,0.125W	91637	MFF1816G71501F
R5794	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R5798	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5801	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5818	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5820	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5825	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5830	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R5832	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5834	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R5840	315-0124-00			RES.,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R5841	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R5845	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5865	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5868	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5870	315-0475-00			RES.,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
R5872	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
R5875	321-0220-00			RES.,FXD,FILM:1.91K OHM,1%,0.125W	91637	MFF1816G19100F
R5877	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R5878	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
R5880	321-0705-00			RES.,FXD,FILM:41.7K OHM,1%,0.125W	91637	MFF1816G41701F
R5882	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R5884	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
R5890	321-0331-00			RES.,FXD,FILM:27.4K OHM,1%,0.125W	91637	MFF1816G27401F
R5892	321-0705-00			RES.,FXD,FILM:41.7K OHM,1%,0.125W	91637	MFF1816G41701F
R5910	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R5920	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	91637	MFF1816G24900F
R5929	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R5933	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R5935	315-0124-00			RES.,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R5940	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5945	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R5950	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R5965	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5968	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5970	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5975	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5990	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925

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R5994	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	91637	MFF1816G75001F
R5998	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	91637	MFF1816G75001F
R6005	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6008	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6071	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R6075	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R6082	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R6083	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R6086	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6098	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R6108	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6117	321-0354-00			RES.,FXD,FILM:47.5K OHM,1%,0.125W	91637	MFF1816G47501F
R6119	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R6122	321-0297-00	B101000	B119999	RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
R6122	321-0279-00	B120000		RES.,FXD,FILM:7.87K OHM,1%,0.125W	91637	MFF1816G78700F
R6128	321-0261-00	B101000	B119999	RES.,FXD,FILM:5.11K OHM,1%,0.125W	91637	MFF1816G51100F
R6128	321-0233-00	B120000		RES.,FXD,FILM:2.61K OHM,1%,0.125W	91637	MFF1816G26100F
R6132	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	91637	MFF1816G36500F
R6136	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	91637	MFF1816G23700F
R6142	321-0421-00	B101000	B119999	RES.,FXD,FILM:237K OHM,1%,0.125W	91637	MFF1816G23702F
R6142	321-0406-00	B120000		RES.,FXD,FILM:165K OHM,1%,0.125W	91637	MFF1816G16502F
R6144	321-0215-00			RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
R6148	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6152	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6154	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6158	322-0210-00	B101000	B119999	RES.,FXD,FILM:1.5K OHM,1%,0.25W	75042	CEBT0-1501F
R6158	322-0205-00	B120000		RES.,FXD,FILM:1.33K OHM,1%,0.25W	91637	MFF1421G13300F
R6164	323-0181-00	B101000	B119999	RES.,FXD,FILM:750 OHM,1%,0.50W	75042	CECT0-7500F
R6164	323-0176-00	B120000		RES.,FXD,FILM:665 OHM,1%,0.50W	75042	CECT0-6650F
R6195	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R6202	311-0644-00	B101000	B119999	RES.,VAR,NONWIR:20K OHM,10%,0.50W	73138	82-34-1
R6202	311-1269-00	B120000		RES.,VAR,NONWIR:20K OHM,10%,0.50W	32997	3329P-L58-203
R6249	321-0394-00			RES.,FXD,FILM:124K OHM,1%,0.125W	91637	MFF1816G12402F
R6284	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6288	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R6304	311-1269-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	32997	3329P-L58-203
R6314	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R6324	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R6334	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6344	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6354	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R6362	311-1273-00			RES.,VAR,NONWIR:200K OHM,10%,0.5W	32997	3329P-L58-204
R6363	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R6364	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R6368	321-0829-07			RES.,FXD,FILM:202 OHM,0.1%,0.125W	91637	MFF1816C202R0B
R6370	321-0829-07			RES.,FXD,FILM:202 OHM,0.1%,0.125W	91637	MFF1816C202R0B
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R6375	SELECTED					
R6384	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R6392	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6395	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6398	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R6448	321-0130-00			RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
R6458	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R6463	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R6467	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R6468	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225

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R6472	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R6474	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R6504	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R6506	321-0319-00			RES.,FXD,FILM:20.5K OHM,1%,0.125W	91637	MFF1816G20501F
R6508	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6512	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R6514	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
R6516	321-0219-00			RES.,FXD,FILM:1.87K OHM,1%,0.125W	91637	MFF1816G18700F
R6518	321-0240-00			RES.,FXD,FILM:3.09K OHM,1%,0.125W	91637	MFF1816G30900F
R6522	321-0182-00			RES.,FXD,FILM:768 OHM,1%,0.125W	91637	MFF1816G768R0F
R6524	321-0246-00			RES.,FXD,FILM:3.57K OHM,1%,0.125W	91637	MFF1816G35700F
R6526	321-0130-00			RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
R6528	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R6531	321-0319-00			RES.,FXD,FILM:20.5K OHM,1%,0.125W	91637	MFF1816G20501F
R6533	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6535	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R6537	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
R6539	321-0219-00			RES.,FXD,FILM:1.87K OHM,1%,0.125W	91637	MFF1816G18700F
R6542	321-0240-00			RES.,FXD,FILM:3.09K OHM,1%,0.125W	91637	MFF1816G30900F
R6544	321-0182-00			RES.,FXD,FILM:768 OHM,1%,0.125W	91637	MFF1816G768R0F
R6548	321-0246-00			RES.,FXD,FILM:3.57K OHM,1%,0.125W	91637	MFF1816G35700F
R6552	321-0155-00			RES.,FXD,FILM:402 OHM,1%,0.125W	91637	MFF1816G402R0F
R6555	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	91637	MFF1816G45300F
R6558	321-0287-00			RES.,FXD,FILM:9.53K OHM,1%,0.125W	91637	MFF1816G95300F
R6564	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6566	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
	----- -----			(NOMINAL VALUE, SELECTED)		
R6578	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6579	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R6582	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R6584	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R6586	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R6612	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6614	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6634	321-0197-00			RES.,FXD,FILM:1.1K OHM,1%,0.125W	91637	MFF1816G11000F
R6638	321-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.125W	91637	MFF1816G15800F
R6642	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R6646	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R6648	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6663	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R6668	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R6673	311-1265-00			RES.,VAR,NONWIR:2K OHM,10%,0.50W	32997	3329P-L58-202
R6677	321-0303-00			RES.,FXD,FILM:14K OHM,1%,0.125W	91637	MFF1816G14001F
R6684	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R6689	321-0300-00			RES.,FXD,FILM:13K OHM,1%,0.125W	91637	MFF1816G13001F
R6706	315-0393-00	XB120000		RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R6724	321-0358-00			RES.,FXD,FILM:52.3K OHM,1%,0.125W	91637	MFF1816G52301F
R6728	321-0262-00	XB120000		RES.,FXD,FILM:5.23K OHM,1%,0.125W	91637	MFF1816G52300F
R6734	321-0354-00	XB120000		RES.,FXD,FILM:47.5K OHM,1%,0.125W	91637	MFF1816G47501F
R6736	311-1271-00	XB120000		RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R6741	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R6758	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6782	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
	----- -----			(NOMINAL VALUE, SELECTED)		
R6791	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R6793	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
	----- -----			(NOMINAL VALUE, SELECTED)		

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R6798	321-0230-00			RES.,FXD,FILM:2.43K OHM,1%,0.125W	91637	MFF1816G24300F
R6833	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6836	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6842	321-0271-00			RES.,FXD,FILM:6.49K OHM,1%,0.125W	91637	MFF1816G64900F
R6844	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816G32400F
R6848	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6859	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R6860	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R6864	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R6866	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R6868	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R6875	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6883	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6892	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6898	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R6904	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6910	321-0341-00			RES.,FXD,FILM:34.8K OHM,1%,0.125W	91637	MFF1816G34801F
R6912	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6920	321-0309-00			RES.,FXD,FILM:16.2K OHM,1%,0.125W	91637	MFF1816G16201F
R6926	321-0357-00			RES.,FXD,FILM:51.1K OHM,1%,0.125W	91637	MFF1816G51101F
R6938	311-1269-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	32997	3329P-L58-203
R6942	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R6944	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R6956	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R6977	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R6981	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6983	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R6992	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6996	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R7005	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7030	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R7034	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R7051	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R7131	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
R7138	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
R7143	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R7181	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R7215	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R7236	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R7237	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R7238	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7240	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7241	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R7261	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R7331	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7333	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R7341	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7351	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R7353	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R7355	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R7357	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	32997	3386F-T04-102
R7361	311-0613-00			RES.,VAR,NONWIR:100K OHM,10%,0.50W	73138	82-27-2
R7371	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7381	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7383	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R7385	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R7441	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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R7443	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816G32400F
R7445	321-0305-00			RES.,FXD,FILM:14.7K OHM,1%,0.125W	91637	MFF1816G14701F
R7453	311-1227-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	32997	3386F-T04-502
R7461	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
R7491	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7492	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7541	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	91637	MFF1816G75001F
R7542	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7546	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R7551	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	91637	MFF1816G31600F
R7553	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	91637	MFF1816G31600F
R7554	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7555	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R7561	311-1223-00			RES.,VAR,NONWIR:TRMR,250 OHM,0.5W	02111	63M251T602
R7564	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R7571	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R7581	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
R7583	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R7591	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7615	311-0634-00			RES.,VAR,NONWIR:TRMR,500 OHM,0.5W	32997	3326H-G48-501
R7660	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7661	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R7685	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R7691	321-0224-00			RES.,FXD,FILM:2.1K OHM,1%,0.125W	91637	MFF1816G21000F
R7711	321-0168-00			RES.,FXD,FILM:549 OHM,1%,0.125W	91637	MFF1816G549R0F
R7721	321-0101-00			RES.,FXD,FILM:110 OHM,1%,0.125W	91637	MFF1816G110R0F
R7723	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R7725	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R7727	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R7729	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R7731	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R7733	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R7735	311-1223-00			RES.,VAR,NONWIR:TRMR,250 OHM,0.5W	02111	63M251T602
R7751	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W	91637	MFF1816G66500F
R7753	321-0159-00			RES.,FXD,FILM:442 OHM,1%,0.125W	91637	MFF1816G442R0F
R7761	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R7763	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R7781	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7841	321-0219-00			RES.,FXD,FILM:1.87K OHM,1%,0.125W	91637	MFF1816G18700F
R7843	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R7851	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R7853	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R7891	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7893	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R7901	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R7911	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R7912	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R7913	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R7915	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R7921	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R7923	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7931	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7933	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7935	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7941	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7943	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7951	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225

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R7953	301-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.50W	01121	EB8215
R7955	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R7961	321-0105-00			RES.,FXD,FILM:121 OHM,1%,0.125W	91637	MFF1816G121R0F
R7963	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R7971	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7973	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R7981	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R7983	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R7991	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R7993	311-1221-00			RES.,VAR,NONWIR:50 OHM,20%,0.50W	32997	3386F-T04-500
R7995	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8012	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8015	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R8018	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R8020	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R8030	311-0978-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	82-4-2
R8035	315-0562-00	B101000	B119999	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R8035	315-0392-00	B120000		RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R8040	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R8050	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R8058	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R8060	311-1267-00	B101000	B119999	RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R8060	311-1263-00	B120000		RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R8068	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R8070	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R8078	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R8125	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R8128	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R8130	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R8138	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8150	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R8155	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8165	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R8170	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R8172	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8185	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R8186	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R8188	321-0184-00	B101000	B119999	RES.,FXD,FILM:806 OHM,1%,0.125W	91637	MFF1816G806R0F
R8188	321-0207-00	B120000		RES.,FXD,FILM:1.4K OHM,1%,0.125W	91637	MFF1816G14000F
R8189	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R8190	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R8210	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R8215	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R8240	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8245	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R8260	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R8275	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8280	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R8310	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R8330	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R8333	315-0122-00	B101000	B119999X	RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R8335	315-0471-00	B101000	B119999X	RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R8338	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8370	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R8372	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R8380	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R8415	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725

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R8440	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R8450	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R8472	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8475	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8494	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8518	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R8538	321-0293-00	B101000	B162642	RES.,FXD,FILM:11K OHM,1%,0.125W	91637	MFF1816G11001F
R8538	321-0275-00	B162643		RES.,FXD,FILM:7.15K OHM,1%,0.125W	91637	MFF1816G71500F
R8540	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8550	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8552	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8555	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8565	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R8568	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8570	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8595	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8612	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8615	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8618	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R8630	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R8632	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R8650	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8652	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8654	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8655	321-0154-00			RES.,FXD,FILM:392 OHM,1%,0.125W	91637	MFF1816G392R0F
R8658	321-0154-00			RES.,FXD,FILM:392 OHM,1%,0.125W	91637	MFF1816G392R0F
R8668	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8669	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8670	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8710	321-0293-00			RES.,FXD,FILM:11K OHM,1%,0.125W	91637	MFF1816G11001F
R8715	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R8720	321-0366-00			RES.,FXD,FILM:63.4K OHM,1%,0.125W	91637	MFF1816G63401F
R8730	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R8740	321-0193-00	B101000	B119999	RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8740	321-0201-00	B120000		RES.,FXD,FILM:1.21K OHM,1%,0.125W	91637	MFF1816G12100F
R8745	321-0272-07			RES.,FXD,FILM:6.65K OHM,0.1%,0.125W	91637	MFF1816C66500B
R8750	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3329P-L58-101
R8752	321-0829-02			RES.,FXD,FILM:202 OHM,0.5%,0.125W	91637	MFF1816D202R0D
R8755	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R8760	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R8765	321-0217-03			RES.,FXD,FILM:1.78K OHM,0.25%,0.125W	91637	MFF1816D17800C
R8770	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R8772	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R8775	321-0272-07			RES.,FXD,FILM:6.65K OHM,0.1%,0.125W	91637	MFF1816C66500B
R8814	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R8830	311-1269-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	32997	3329P-L58-203
R8835	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R8840	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8842	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8844	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8846	321-0829-02			RES.,FXD,FILM:202 OHM,0.5%,0.125W	91637	MFF1816D202R0D
R8848	321-0664-00			RES.,FXD,FILM:1.56K OHM,0.5%,0.125W	91637	MFF1816D15600D
R8870	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R8872	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8874	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8876	321-0816-07			RES.,FXD,FILM:5K OHM,0.1%,0.125W	91637	MFF1816C50000B
R8895	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705

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R8910	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R8918	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8930	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R8940	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8943	315-0104-00	B101000	B119999	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R8943	315-0303-00	B120000		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R8946	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8958	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8960	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3329P-L58-101
R8970	321-0816-07			RES.,FXD,FILM:5K OHM,0.1%,0.125W	91637	MFF1816C50000B
R8974	321-0915-07			RES.,FXD,FILM:1.291K OHM,0.1%,0.125W	24546	NE55E112910B
R8976	321-0915-07			RES.,FXD,FILM:1.291K OHM,0.1%,0.125W	24546	NE55E112910B
R8990	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R9002	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R9022	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9081	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R9083	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9086	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R9087	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R9088	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R9089	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R9090	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R9091	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R9093	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R9205	311-1182-00			RES.,VAR,NONWIR:1.5K OHM,10%,0.5W	01121	W7835
R9209	311-0326-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	01121	W7683
R9210	311-0585-00			RES.,VAR,NONWIR:15K OHM,20%,0.25W	71590	BA201-061
R9212	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R9215	311-0310-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	01121	W-7350A
R9223	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R9225	311-1095-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	12697	382-CM40386
R9230	321-0267-00			RES.,FXD,FILM:5.9K OHM,1%,0.125W	91637	MFF1816G59000F
R9231	321-0295-00			RES.,FXD,FILM:11.5K OHM,1%,0.125W	91637	MFF1816G11501F
R9232	321-0287-00			RES.,FXD,FILM:9.53K OHM,1%,0.125W	91637	MFF1816G95300F
R9233	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R9234	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W	91637	MFF1816G66500F
R9235	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	91637	MFF1816G54900F
R9236	321-0257-00			RES.,FXD,FILM:4.64K OHM,1%,0.125W	91637	MFF1816G46400F
R9237	321-0249-00			RES.,FXD,FILM:3.83K OHM,1%,0.125W	91637	MFF1816G38300F
R9238	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	91637	MFF1816G34000F
R9239	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	91637	MFF1816G34000F
R9280	311-0068-00			RES.,VAR,NONWIR:500K OHM,20%,0.50W	12697	381-CM15331
R9291	321-1170-03			RES.,FXD,FILM:583 OHM,0.25%,0.125W	91637	MFF1816D583R0C
R9292	321-0180-03			RES.,FXD,FILM:732 OHM,0.25%,0.125W	24546	NC55C7320C
R9293	321-0190-03			RES.,FXD,FILM:931 OHM,0.25%,0.125W	24546	NC55C9310C
R9294	321-0202-03			RES.,FXD,FILM:1.24K OHM,0.25%,0.125W	24546	NC55C1241C
R9295	321-1216-03			RES.,FXD,FILM:1.76K OHM,0.25%,0.125W	91637	MFF1816D17600C
R9296	321-0233-03			RES.,FXD,FILM:2.61K OHM,0.25%,0.125W	24546	NC55C2611C
R9297	321-1254-03			RES.,FXD,FILM:4.37K OHM,0.25%,0.125W	24546	NC55C4371C
R9298	321-1283-03			RES.,FXD,FILM:8.76K OHM,0.25%,0.125W	91637	MFF1816D87600C
R9299	321-1329-03			RES.,FXD,FILM:26.4K OHM,0.25%,0.125W	91637	MFF1816D26401C
R9800	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9801	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R9802	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9803	308-0344-00			RES.,FXD,WW:18.2 OHM,1%,3W	91637	RS2B-K18R20F
R9804	308-0590-00			RES.,FXD,WW:0.25 OHM,5%,3W	91637	RS2B-ER2500J
R9806	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315

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R9808	321-0197-00			RES.,FXD,FILM:1.1K OHM,1%,0.125W	91637	MFF1816G11000F
R9810	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R9812	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R9814	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9816	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9818	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R9830	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9831	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R9832	308-0245-00			RES.,FXD,WW:0.6 OHM,5%,2W	91637	CW2B30 0.60HM 5%
R9834	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9836	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R9838	321-0224-00			RES.,FXD,FILM:2.1K OHM,1%,0.125W	91637	MFF1816G21000F
R9840	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R9842	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9844	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9846	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R9848	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R9850	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R9851	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R9852	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R9854	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R9856	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R9858	321-0173-00			RES.,FXD,FILM:619 OHM,1%,0.125W	91637	MFF1816G619R0F
R9860	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9862	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R9864	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9866	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9868	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9870	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R9872	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R9874	308-0245-00			RES.,FXD,WW:0.6 OHM,5%,2W	91637	CW2B30 0.60HM 5%
S9201	260-0276-00			SWITCH,TOGGLE:DPST,15A,125V	27193	7561 K 4
S9202	----- -----			(SEE MPL LINE VOLTAGE SELECTOR)		
S9203	----- -----			(SEE MPL LINE VOLTAGE SELECTOR)		
S9205	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9212	260-1248-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-1248-00
S9213	260-1249-00			SWITCH,LEVER:2 SECT,3 POSN,30 DEG	80009	260-1249-00
S9225	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9230	260-0621-00			SWITCH,LEVER:1 SECT,3 POSN,30 DEG	80009	260-0621-00
S9235	260-1252-00			SWITCH,ROTARY:1 SECT,5 POSN,45 DEG	80009	260-1252-00
S9240	260-1251-00			SWITCH,ROTARY:1 SECT,10 POSN,30 DEG	80009	260-1251-00
S9250	260-0664-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0664-00
S9255	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9260	260-1587-00			SWITCH,ROTARY:1 SECT,12 POSN,45 DEG	80009	260-1587-00
S9270	260-0621-00			SWITCH,LEVER:1 SECT,3 POSN,30 DEG	80009	260-0621-00
S9285	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9290	260-1374-00			SWITCH,ROTARY:1 SECT,12 POSN,30 DEG	80009	260-1374-00
T8660	120-0587-00			XFMR,TOROID:FOUR 10 TURN WINDINGS	80009	120-0587-00
T9001	120-0737-00			XFMR,PWR,STPDN:	80009	120-0737-00
U21	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U101	156-0114-00			MICROCIRCUIT,DI:DIVIDE-BY-12,COUNTER	80009	156-0114-00
U201	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL,14 DIP	01295	SN74121(N OR J)
U301	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U761	155-0022-00			MICROCIRCUIT,DI:ML,CHANNEL SWITCH	80009	155-0022-00
U861	155-0022-00			MICROCIRCUIT,DI:ML,CHANNEL SWITCH	80009	155-0022-00

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U1001	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1031	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1061	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1091	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1101	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U1131	156-0034-00			MICROCIRCUIT,DI:DUAL 4-INPUT NAND GATE	80009	156-0034-00
U1161	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1191	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1202	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U1231	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1261	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1291	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1301	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U1331	156-0034-00			MICROCIRCUIT,DI:DUAL 4-INPUT NAND GATE	80009	156-0034-00
U1361	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1391	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1431	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1461	156-0047-00	B101000	B162510	MICROCIRCUIT,DI:TPL 3-INPUT POS NAND GATE	80009	156-0047-00
U1461	156-0047-02	B162511		MICROCIRCUIT,DI:TPl 3 INP,NAND GATE	27014	DM7410NA+ OR JA+
U2001	156-0078-00			MICROCIRCUIT,DI:1 OF 16 DECODER-DEMUX	80009	156-0078-00
U2061	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2081	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2261	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2281	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2401	156-0078-00			MICROCIRCUIT,DI:1 OF 16 DECODER-DEMUX	80009	156-0078-00
U2461	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2481	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2661	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2681	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2721	156-0037-00			MICROCIRCUIT,DI:2-INPUT +AND/OR/INVERT GATE	80009	156-0037-00
U2741	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U2761	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2781	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2811	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL,14 DIP	01295	SN74121(N OR J)
U2831	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U2861	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U2881	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2911	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7401N OR J
U2931	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U2961	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2981	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7401N OR J
U3100	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	02735	CA3046
U3585	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U3735	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U3755	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U3775	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U3835	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U3855	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U3875	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4151	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4171	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4271	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U4351	156-0078-00			MICROCIRCUIT,DI:1 OF 16 DECODER-DEMUX	80009	156-0078-00
U4471	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	80009	156-0032-00
U4551	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4571	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U4621	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00

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U4622	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4641	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4642	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	80009	156-0145-00
U4661	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4662	156-0079-00			MICROCIRCUIT,DI:DECADE COUNTER,TTL	80009	156-0079-00
U4681	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4721	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U4741	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4761	156-0047-00	B101000	B162510	MICROCIRCUIT,DI:TPL 3-INPUT POS NAND GATE	80009	156-0047-00
U4761	156-0047-02	B162511		MICROCIRCUIT,DI:TPl 3 INP,NAND GATE	27014	DM7410NA+ OR JA+
U4781	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U4721	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U4741	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4761	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4781	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4821	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U4841	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4861	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4881	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U6170	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	02735	CA3046
U7251	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7401N OR J
U7291	156-0067-00	B101000	B142174	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	01295	MICROA741CP
U7291	156-0067-12	B142175		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	01295	UA741CJG
U8070	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U8310	156-0092-00			MICROCIRCUIT,DI:HEX INV W/OPEN COLLECTOR	80009	156-0092-00
U8510	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U8890	156-0130-00	B101000	B162623	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR	80009	156-0130-00
U8890	156-0130-02	B162624		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN	04713	SC77162GH
VR6484	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
VR7161	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR9850	152-0212-00			SEMICOND DEVICE:ZENER,0.5W,9V,5%	04713	SZ50646RL
Y5639	158-0069-00			XTAL UNIT,QTZ:3.579545 MHZ,+/-0.0035%	75378	TX-005

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A0	670-1468-01			CKT BOARD ASSY:VIT INSERTION	80009	670-1468-01
A1	670-1472-00			CKT BOARD ASSY:VERT COUNTER	80009	670-1472-00
A2	672-0670-00			CKT BOARD ASSY:HORIZ TIMING	80009	672-0670-00
A3	670-2349-00			CKT BOARD ASSY:APL STAIRCASE AND COLOR BAR	80009	670-2349-00
A4	670-1469-01	B040500	B112569	CKT BOARD ASSY:FULL FIELD AND VIT	80009	670-1469-01
A4	670-1469-07	B112570		CKT BOARD ASSY:FULL FIELD AND VIT	80009	670-1469-07
A5	670-1487-00			CKT BOARD ASSY:GENLOCK	80009	670-1487-00
A6	670-2039-01	B040500	B109999	CKT BOARD ASSY:FUNCTION GEN	80009	670-2039-01
A6	670-2039-13	B110000		CKT BOARD ASSY:FUNCTION GEN	80009	670-2039-13
A7	670-2042-01			CKT BOARD ASSY:OUTPUT AMP	80009	670-2042-01
A8	670-2351-00			CKT BOARD ASSY:MODULATOR	80009	670-2351-00
A9	670-2350-00	B040500	B112449	CKT BOARD ASSY:SUBCARRIER SYNC	80009	670-2350-00
A9	670-2350-05	B112450	B112846	CKT BOARD ASSY:SUBCARRIER SYNC	80009	670-2350-05
A9	670-2350-07	B112847		CKT BOARD ASSY:SUBCARRIER SYNC	80009	670-2350-07
A10	670-1473-01			CKT BOARD ASSY:POWER,SUPPLY	80009	670-1473-01
A11	670-2327-01	B040500	B101949	CKT BOARD ASSY:RELAY	80009	670-2327-01
A11	670-2327-03	B101950		CKT BOARD ASSY:RELAY	80009	670-2327-03
A12	670-2993-00			CKT BOARD ASSY:ALT APL	80009	670-2993-00
C22	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C24	283-0602-00			CAP.,FXD,MICA D:53PF,5%,300V	00853	D153E530J0
C28	283-0625-00			CAP.,FXD,MICA D:220PF,1%,500V	00853	D105F221F0
C30	283-0632-00			CAP.,FXD,MICA D:87PF,1%,100V	00853	D151E870F0
C50	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C53	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C55	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C64	283-0239-00			CAP.,FXD,CER DI:0.022UF,10%,50V	72982	8121N083X7R0223K
C80	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C90	283-0641-00			CAP.,FXD,MICA D:180PF,1%,100V	00853	D151E181F0
C94	283-0641-00			CAP.,FXD,MICA D:180PF,1%,100V	00853	D151E181F0
C101	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C130	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C150	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C180	283-0239-00			CAP.,FXD,CER DI:0.022UF,10%,50V	72982	8121N083X7R0223K
C185	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C260	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C330	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C335	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C340	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C354	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	05397	T368C476M020AZ
C403	283-0597-00			CAP.,FXD,MICA D:470PF,10%,300V	00853	D153E471K0
C404	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C406	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C410	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C438	238-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C440	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C448	283-0597-00			CAP.,FXD,MICA D:470PF,10%,300V	00853	D153E471K0
C460	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C471	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C472	283-0003-00	B010100	B112846	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C472	283-0238-00	B112847		CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N075X7R0103K
C481	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C488	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C513	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C514	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	56289	5C37Z5U475M050B
C520	290-0367-00			CAP.,FXD,ELCTLT:70UF,20%,6V NONPOLARIZED	56289	30D1802
C537	281-0659-00			CAP.,FXD,CER DI:4.3PF,+/-0.25PF,500V	59660	301-000C0H0439C
C558	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C565	283-0059-00			CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z

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C580	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C593	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C595	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C596	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C610	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	56289	5C37Z5U475M050B
C614	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	90201	TDC107M020WLD
C620	283-0047-00			CAP.,FXD,CER DI:270PF,5%,500V	72982	0831522Z5D00271J
C628	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C650	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C692	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C693	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C694	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C695	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C696	283-0599-00			CAP.,FXD,MICA D:98PF,5%,500V	00853	D105F980J0
C718	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C749	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C779	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C790	290-0526-00			CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
C804	285-0622-00			CAP.,FXD,PLSTC:0.1UF,20%,100V	56289	410P10401
C822	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C844	283-0134-00			CAP.,FXD,CER DI:0.47UF,+80-20%,50V	72982	8131N087Z5U0474Z
C849	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C865	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C879	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C898	290-0526-00			CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M00NLE
C910	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C915	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C918	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C919	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C927	283-0059-00			CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z
C929	283-0059-00			CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z
C959	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C968	283-0672-00			CAP.,FXD,MICA D:200PF,1%,500V	00853	D155F2010F0
C978	281-0541-00	B040500	B081409	CAP.,FXD,CER DI:6.8PF,10%,500V	59660	301-000C0H0689D
C978	281-0504-00	B081410		CAP.,FXD,CER DI:10PF,+/-1PF,500V	59660	301-055C0G0100F
C989	283-0194-00			CAP.,FXD,CER DI:4.7UF,20%,50V	56289	5C37Z5U475M050B
C990	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
C998	290-0135-00			CAP.,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C1000	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C1401	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1460	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1501	285-0835-00			CAP.,FXD,PLSTC:0.22UF,2%,100V	56289	LP66A1B224G002
C1515	281-0580-00			CAP.,FXD,CER DI:470PF,10%,500V	04222	7001-1374
C1601	283-0058-00			CAP.,FXD,CER DI:0.027UF,10%,100V	72982	8131N147X7R0273K
C1650	281-0580-00			CAP.,FXD,CER DI:470PF,10%,500V	04222	7001-1374
C1701	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1720	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C1730	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C1755	283-0641-00			CAP.,FXD,MICA D:180PF,1%,100V	00853	D151E181F0
C1760	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
C1770	283-0593-00			CAP.,FXD,MICA D:0.01UF,1%,100V	00853	D301F103F0
C1780	285-0626-00			CAP.,FXD,PLSTC:0.0015UF,10%,100V	56289	410P102
C1798	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C1895	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C1902	283-0622-00			CAP.,FXD,MICA D:450PF,1%,300V	00853	D153F451F0
C1930	281-0629-00			CAP.,FXD,CER DI:33PF,5%,600V	04222	7027-C0G-330J
C1940	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	04222	7001-1380
C1950	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9

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C1995	281-0562-00			CAP.,FXD,CER DI:39PF,10%,500V	59660	301-000U2J0390K
C1998	283-0593-00			CAP.,FXD,MICA D:0.01UF,1%,100V	00853	D301F103F0
C2030	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C2722	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
C2810	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C2929	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C2936	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C2958	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C3126	283-0000-00	B040500	B091889X	CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C3359	283-0642-00			CAP.,FXD,MICA D:33PF,+/-0.5PF,300V	00853	D10-5E330G
C3421	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C3431	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C3441	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C3443	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C3461	283-0634-00			CAP.,FXD,MICA D:65PF,1%,100V	00853	D151E650F0
C3467	283-0637-00			CAP.,FXD,MICA D:20PF,2.5%,100V	00853	D151E200D0
C3470	281-0131-00			CAP.,VAR,AIR DI:2.4-24.5PF,250V	74970	189-0509-075
C3473	283-0638-00			CAP.,FXD,MICA D:130PF,1%,100V	00853	D151F131F0
C3491	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C3551	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C3565	281-0131-00			CAP.,VAR,AIR DI:2.4-24.5PF,250V	74970	189-0509-075
C3601	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C3651	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C3881	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C4188	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4271	283-0268-00	XB112570		CAP.,FXD,CER DI:0.015UF,10%,50V	56289	1C20X7R153K050B
C4460	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C4620	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4662	283-0620-00			CAP.,FXD,MICA D:470PF,1%,300V	00853	D153F471F0
C4721	283-0028-00			CAP.,FXD,CER DI:0.0022UF,20%,50V	56289	19C606
C5022	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C5040	283-0111-00	B040500	B070829	CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5040	281-0167-00	B070830		CAP.,VAR,CER DI:9-45PF,200V	59660	538-011D9-45
C5042	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5048	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C5049	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5050	283-0256-00			CAP.,FXD,CER DI:130PF,5%,100V	51642	200-100N1500131J
C5065	290-0114-00			CAP.,FXD,ELCTLT:47UF,20%,6V	56289	150D476X0006B2
C5070	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5085	290-0134-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	150D226X0015B2
C5120	283-0256-00			CAP.,FXD,CER DI:130PF,5%,100V	51642	200-100N1500131J
C5141	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5170	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5201	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5210	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5225	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C5245	283-0192-00	B040500	B112557	CAP.,FXD,CER DI:0.47UF,+80-20%,3V	000JO	RT3474Z-H
C5245	283-0203-00	B112558		CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C5258	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C5270	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C5291	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5330	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	91418	MX0104Z1205R5
C5335	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5342	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5362	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5410	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	91418	MX0104Z1205R5
C5435	283-0192-00	B040500	B112557	CAP.,FXD,CER DI:0.47UF,+80-20%,3V	000JO	RT3474Z-H

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C5435	283-0203-00	B112558		CAP.,FXD,CER DI:0.47UF,20%,50V	72982	8131M058Z5U0474M
C5450	283-0104-00			CAP.,FXD,CER DI:2000PF,5%,500V	72982	811-565B202J
C5468	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5518	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5540	283-0104-00			CAP.,FXD,CER DI:2000PF,5%,500V	72982	811-565B202J
C5568	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5570	283-0017-00	B040500	B112399	CAP.,FXD,CER DI:1UF,+80-20%,3V	000JO	RT31052-H
C5570	283-0059-00	B112400		CAP.,FXD,CER DI:1UF,+80-20%,50V	72982	8131N031Z5U0105Z
C5572	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5615	283-0618-00			CAP.,FXD,MICA D:130PF,2%,400V	00853	D155F131G0
C5620	283-0618-00			CAP.,FXD,MICA D:130PF,2%,400V	00853	D155F131G0
C5622	283-0004-00	B040500	B081409	CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5622	283-0081-00	B081410		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C5648	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5660	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5665	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5670	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	91418	MX223Z2504R0
C5715	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5718	281-0503-00			CAP.,FXD,CER DI:8PF,+/-0.5PF,500V	59660	301-000C0H0809D
C5720	283-0004-00	B040500	B081409	CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5720	283-0081-00	B081410		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C5750	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5775	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5788	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	59660	8151B202Y5S0103M
C5799	283-0079-00			CAP.,FXD,CER DI:0.01UF,20%,250V	59660	8151B202Y5S0103M
C5810	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5820	283-0651-00			CAP.,FXD,MICA D:430PF,1%,500V	00853	D155F431F0
C5824	283-0119-00			CAP.,FXD,CER DI:2200PF,5%,200V	59660	855-536Y5E0222J
C5826	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	0831085Z5E00471J
C5834	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C5840	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C5850	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5862	290-0415-00			CAP.,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C6042	281-0613-00			CAP.,FXD,CER DI:10PF,+/-1PF,200V	59660	374001C0G100F
C6047	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C6051	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0020HA1
C6071	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C6078	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C6108	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6362	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C6372	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C6382	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C6486	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C6508	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C6533	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C6562	281-0510-00			CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	59660	301-000C0G0220M
C6606	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C6614	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C6663	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C6665	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C6682	283-0003-00	B040500	B081409	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C6682	283-0081-00	B081410	B112672	CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C6682	283-0178-00	B112673		CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C6693	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C6712	290-0530-00			CAP.,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C6736	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C6740	281-0611-00			CAP.,FXD,CER DI:2.7PF,+/-0.25PF,200V	59660	374-018C0J0279C
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C6748	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C6763	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,50V	72982	8121N083Z5U0104Z
C6788	281-0153-00			CAP.,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C6866	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6887	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C6979	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C7061	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C7212	283-0634-00			CAP.,FXD,MICA D:65PF,1%,100V	00853	D151E650F0
C7301	281-0205-00			CAP.,VAR,PLSTC:5.5-65PF,100V	80031	2810C5R565QJ02F0
C7303	283-0625-00			CAP.,FXD,MICA D:220PF,1%,500V	00853	D105F221F0
C7305	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C7307	283-0596-00			CAP.,FXD,MICA D:528PF,1%,300V	00853	D153F5280F0
C7309	283-0636-00			CAP.,FXD,MICA D:36PF,1.4%,100V	00853	D155E360G0
C7310	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C7311	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C7312	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C7383	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C7401	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C7403	283-0603-00			CAP.,FXD,MICA D:113PF,2%,300V	00853	D153F1130G0
C7431	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C7451	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C7461	281-0166-00			CAP.,VAR,AIR DI:1.9-15.7PF,250V	74970	187-0109-055
C7463	281-0166-00			CAP.,VAR,AIR DI:1.9-15.7PF,250V	74970	187-0109-055
C7481	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C7501	283-0636-00			CAP.,FXD,MICA D:36PF,1.4%,100V	00853	D155E360G0
C7503	283-0674-00			CAP.,FXD,MICA D:85PF,1%,500V	00853	D155F850F0
C7505	283-0663-00			CAP.,FXD,MICA D:16.8PF,+/-0.5PF,500V	00853	D155C16R8D0
C7507	283-0600-00			CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0
C7508	283-0639-00			CAP.,FXD,MICA D:56PF,1%,100V	00853	D151E560F0
C7509	283-0638-00			CAP.,FXD,MICA D:130PF,1%,100V	00853	D151F131F0
C7533	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C7555	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C7601	283-0601-00			CAP.,FXD,MICA D:22PF,10%,300V	00853	D153C220K0
C7603	283-0635-00			CAP.,FXD,MICA D:51PF,1%,100V	00853	D151E510F0
C7671	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-519-Y5P-102P
C7711	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C7731	283-0644-00			CAP.,FXD,MICA D:150PF,1%,500V	00853	D155F151F0
C7781	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C7783	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	05397	T368C476M020AZ
C7791	281-0661-00			CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V	04222	7001-1268
C7801	281-0626-00			CAP.,FXD,CER DI:3.3PF,1%,500V	59660	301-000C0J0339B
C7803	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C7861	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C7883	283-0111-00	B040500	B081409	CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C7883	283-0177-00	B081410		CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
C7891	283-0633-00			CAP.,FXD,MICA D:77PF,1%,100V	00853	D151E770F0
C7901	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C7903	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C7932	283-0164-00			CAP.,FXD,CER DI:2.2UF,20%,25V	72982	8141N037Z5U0225M
C7951	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C8031	290-0246-00	B040500	B050559	CAP.,FXD,ELCTLT:3.3UF,10%,15V	56289	162D335X9015CD2
C8031	290-0522-00	B050560		CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C8051	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8101	283-0104-00			CAP.,FXD,CER DI:2000PF,5%,500V	72982	811-565B202J
C8131	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8179	283-0618-00			CAP.,FXD,MICA D:130PF,2%,400V	00853	D155F131G0

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C8285	283-0643-00			CAP.,FXD,MICA D:22PF,+/-0.5PF,300V	00853	D105E220D0
C8307	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C8351	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C8359	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8403	283-0630-00			CAP.,FXD,MICA D:110PF,1%,100V	00853	D151E111F0
C8427	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C8435	283-0649-00			CAP.,FXD,MICA D:105PF,1%,300V	00853	D153F1050F0
C8459	283-0598-00			CAP.,FXD,MICA D:253PF,5%,300V	09023	CD15EC(253)J03
C8477	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C8481	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
C8503	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C8505	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C8527	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C8529	283-0648-00			CAP.,FXD,MICA D:10PF,5%,100V	00853	D151C100D0
C8533	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8535	283-0639-00			CAP.,FXD,MICA D:56PF,1%,100V	00853	D151E560F0
C8587	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8627	283-0630-00			CAP.,FXD,MICA D:110PF,1%,100V	00853	D151E111F0
C8653	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8657	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8659	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8665	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8677	281-0116-00			CAP.,VAR,AIR DI:1.5-9.1PF,530V	74970	189-0754-075
C8685	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8729	283-0687-00			CAP.,FXD,MICA D:560PF,2%,300V	00853	D153F561G0
C8733	283-0600-00			CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0
C8751	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8757	283-0084-00			CAP.,FXD,CER DI:270PF,5%,1000V	59660	838-533B271J
C8787	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8789	281-0510-00	XB050560		CAP.,FXD,CER DI:22PF,+/-4.4PF,500V	59660	301-000C0G0220M
C8791	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8827	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8845	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8881	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8901	283-0134-00			CAP.,FXD,CER DI:0.47UF,+80-20%,50V	72982	8131N087Z5U0474Z
C8903	283-0054-00			CAP.,FXD,CER DI:150PF,5%,200V	59660	855-535U2J0 151J
C8933	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	56289	1C10Z5U223M050B
C8935	283-0004-00	B040500	B081409	CAP.,FXD,CER DI:0.02UF,+80-20%,150V	91418	SP203Z151-4R9
C8935	283-0081-00	B081410		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	91418	MX104Z2504R0
C9011	290-0334-00			CAP.,FXD,ELCTLT:1250UF,+75-10%,50V	56289	D46468
C9042	290-0321-00			CAP.,FXD,ELCTLT:11000UF,+100-10%,15V	90201	20-24012
C9061	290-0086-00			CAP.,FXD,ELCTLT:2000UF,+150-10%,35OV	56289	D27740
C9083	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9086	283-0220-00	XB101950		CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075X7R0103M
C9090	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C9091	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C9092	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9094	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9095	281-0625-00			CAP.,FXD,CER DI:35PF,5%,500V	59660	308-000C0G0350J
C9215	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C9218	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	91418	SP103Z151-4R9
C9802	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	19396	DU490B103J
C9810	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9824	290-0296-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	150D107X0020S2
C9830	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	19396	DU490B103J
C9832	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9840	290-0135-00			CAP.,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2

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C9850	290-0135-00			CAP.,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C9852	283-0026-00			CAP.,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9854	281-0549-00			CAP.,FXD,CER DI:68PF,10%,500V	59660	301-000U2J0680K
C9856	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	19396	DU490B103J
CR7	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR35	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR250	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR329	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR338	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR456	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR460	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR469	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR476	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR477	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR478	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR479	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR480	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR485	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR487	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR489	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR494	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR495	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR496	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR497	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR498	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR499	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR584	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR585	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR588	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR651	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR664	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR720	152-0269-00	B040500	B091519	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR720	152-0269-01	B091520		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR740	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR796	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR924	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR944	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR992	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1301	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1420	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1510	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1544	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1720	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1740	152-0269-00	B040500	B091519	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR1740	152-0269-01	B091520		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR1795	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1830	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR1930	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR2830	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3016	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3022	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3024	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3026	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3036	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3056	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3096	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

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CR3098	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3134	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3136	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3140	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3144	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3192	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3194	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3275	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3277	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3279	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3294	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3358	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3373	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3375	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3377	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3386	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3392	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3394	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3411	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3413	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3451	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3531	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3533	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3551	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3641	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3651	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3653	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3711	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR3721	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3723	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3725	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3811	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR3821	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3823	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3881	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3911	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR3913	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3923	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR3921	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR4570	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR4784	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5010	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5015	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5030	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5035	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5255	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5260	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5265	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5270	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5331	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
CR5335	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5340	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5365	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5370	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5380	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5411	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
CR5415	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

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CR5420	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5570	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5571	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5572	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5674	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5676	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5835	152-0269-00	B040500	B091519	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR5835	152-0269-01	B091520		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR5855	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5865	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5877	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5878	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5885	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5887	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR5940	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6013	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6017	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6019	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6022	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6028	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6033	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6037	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6048	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6112	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6114	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6118	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6122	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6128	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6132	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6136	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6182	152-0125-00			SEMICOND DEVICE:TUNNEL,15PF,4.7MA	03508	STD704
CR6306	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6308	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6316	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6318	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6322	152-0442-00	B040500	B109999	SEMICOND DEVICE:SILICON,MATCHED PAIR	80009	152-0442-00
	----- -----			(CR6322 FURNISHED AS A UNIT WITH CR6348)		
CR6322	152-0748-00	B110000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6328	152-0442-00	B040500	B109999	SEMICOND DEVICE:SILICON,MATCHED PAIR	80009	152-0442-00
	----- -----			(CR6328 FURNISHED AS A UNIT WITH CR6404)		
CR6328	152-0748-00	B110000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6331	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6335	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6338	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6344	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	07263	FD7003
CR6348	152-0442-00	B040500	B109999	SEMICOND DEVICE:SILICON,MATCHED PAIR	80009	152-0442-00
	----- -----			(CR6348 FURNISHED AS A UNIT WITH CR6322)		
CR6348	152-0748-00	B110000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6376	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
CR6404	152-0442-00	B040500	B109999	SEMICOND DEVICE:SILICON,MATCHED PAIR	80009	152-0442-00
	----- -----			(CR6404 FURNISHED AS A UNIT WITH CR6328)		
CR6404	152-0748-00	B110000		SEMICOND DEVICE:SILICON,SCHOTTKY,7V,0.7PF	80009	152-0748-00
CR6464	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6466	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6469	152-0457-00			SEMICOND DEVICE:SILICON,25V	28480	5082-2068
CR6588	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6624	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

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CR6634	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6703	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6709	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6789	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6885	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6913	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6915	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6918	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6920	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6923	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6925	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6966	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6987	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6988	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7008	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7041	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7091	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7093	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7095	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7190	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7215	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7218	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7341	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7343	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7345	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7347	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7711	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR7951	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8005	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8603	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8604	152-0141-02	XB060000		SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8679	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8681	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8789	152-0269-00	B040500	B041519	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR8789	152-0269-01	B091520		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR8801	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8803	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8839	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8843	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR8931	152-0269-00	B040500	B091519	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR8931	152-0269-01	B091520		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR8957	152-0269-00	B040500	B091519	SEMICOND DEVICE:SILICON,VAR VCAP.,4V,33PF	04713	SMV1263
CR8957	152-0269-01	B091520		SEMICOND DEVICE:VVC,SI,33PF,5%,35V	80009	152-0269-01
CR9081	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR9085	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR9089	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
CR9802	152-0198-00			SEMICOND DEVICE:SILICON,200V,3A	03508	1N5624
CR9804	152-0198-00			SEMICOND DEVICE:SILICON,200V,3A	03508	1N5624
CR9830	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9830	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9832	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9832	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9834	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9834	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9836	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9836	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9870	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016

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CR9870	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9872	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9872	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9874	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9874	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
CR9876	152-0066-00	B040500	B101949	SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
CR9876	152-0066-01	B101950		SEMICOND DEVICE:SILICON,400V,1A	15238	LG4012
DS9201	150-0018-00	B040500	B112756	LAMP,INCAND:6.3V	08806	12
DS9201	150-0045-00	B112757		LAMP,INCAND:5V,0.06A	08806	685
DS9202	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9210	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9211	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9220	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9221	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
DS9222	150-0048-01			LAMP,INCAND:5V,0.06A,SEL	08806	683AS15
F9201	159-0042-00			FUSE,CARTRIDGE:3AG,0.75A,250V,FAST-BLOW	71400	AGC 3/4
F9202	159-0025-00			FUSE,CARTRIDGE:3AG,0.5A,250V,FAST-BLOW	71400	AGC 1/2
FL9201	119-0095-06	B040500	B081359	FILTER,RAD INTE:400 HZ,250 VAC	56289	JN10-2319A1
FL9201	119-0389-00	B081360		FILTER,RAD INTE:115/230V,3A	02777	F11935-3
J9001	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9002	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9003	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9004	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9005	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9006	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9007	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9008	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9009	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9010	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9011	131-0126-00			CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
J9014	131-0324-00			CONNECTOR,RCPT,:24 PIN,FEMALE	71785	222-42-24-060
J9210	131-0106-02			CONNECTOR,RCPT,:BNC	24931	28JR178-1
J9250	131-0106-02			CONNECTOR,RCPT,:BNC	24931	28JR178-1
K390	148-0064-00			RELAY,REED:SPST	95348	CB-831A-26
K9080	148-0086-00			RELAY,REED:SPDT,COIL 5V,150 OHM	78277	191TE1C15G
K9082	148-0034-00	B040500	B091659	RELAY,ARMATURE:DPDT,15VDC,600 OHM	80009	148-0034-00
K9082	148-0107-04	B091660		RELAY,ARMATURE:W/8 PIN HEADER	80009	148-0107-04
K9089	148-0034-00	B040500	B091659	RELAY,ARMATURE:DPDT,15VDC,600 OHM	80009	148-0034-00
K9089	148-0107-04	B091660		RELAY,ARMATURE:W/8 PIN HEADER	80009	148-0107-04
L20	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L30	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L94	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L438	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L440	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L520	276-0507-00			SHIELDING BEAD,:FERRITE	78488	57-3443
L720	108-0226-00			COIL,RF:100UH	76493	DWG B4257
L912	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L1670	114-0308-00			COIL,RF:2.9-6.5UH	80009	114-0308-00
L1770	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L1850	108-0174-00			COIL,RF:245UH	80009	108-0174-00
L3070	108-0395-00			COIL,RF:64UH	80009	108-0395-00
L5055	108-0317-00			COIL,RF:FIXED,15UH	32159	71501M
L5101	114-0303-00			COIL,RF:6.5-23UH,CORE 276-0506-00	80009	114-0303-00
L5242	108-0174-00			COIL,RF:245UH	80009	108-0174-00

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L5320	108-0174-00			COIL,RF:245UH	80009	108-0174-00
L5601	108-0317-00			COIL,RF:FIXED,15UH	32159	71501M
L5830	108-0231-00			COIL,RF:4.5UH	80009	108-0231-00
L6482	276-0507-00			SHIELDING BEAD,:FERRITE	78488	57-3443
L6852	SELECTED			(ADDED IF NECESSARY)		
L7110	120-0785-00			XFMR,TOROID:12 TURN BIFILAR	80009	120-0785-00
L7301	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L7311	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L7401	114-0278-00			COIL,RF:4.6-16.7UH,CORE 276-0568-00	80009	114-0278-00
L7411	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7501	114-0278-00			COIL,RF:4.6-16.7UH,CORE 276-0568-00	80009	114-0278-00
L7511	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7601	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L7611	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7631	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L8177	114-0281-00			COIL,RF:35-70UH,CORE 276-0540-00	80009	114-0281-00
L8287	114-0281-00			COIL,RF:35-70UH,CORE 276-0540-00	80009	114-0281-00
L8401	114-0219-00			COIL,RF:VARIABLE,43-130UH	80009	114-0219-00
L8431	114-0219-00			COIL,RF:VARIABLE,43-130UH	80009	114-0219-00
L8437	114-0177-00			COIL,RF:280-650UH,SHIELDED	32436	5E-003-4
L8461	114-0278-00			COIL,RF:4.6-16.7UH,CORE 276-0568-00	80009	114-0278-00
L8501	114-0219-00			COIL,RF:VARIABLE,43-130UH	80009	114-0219-00
L8531	114-0219-00			COIL,RF:VARIABLE,43-130UH	80009	114-0219-00
L8951	114-0254-00			COIL,RF:30-60UH,CORE NOT REPLACEABLE	80009	114-0254-00
L8629	114-0177-00			COIL,RF:280-650UH,SHIELDED	32436	5E-003-4
L8953	114-0310-00			COIL,RF:22-80UH	80009	114-0310-00
Q10	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q30	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q40	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q50	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q55	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q60	151-0225-00			TRANSISTOR:SILICON,NPN	07263	S39291
Q70	151-0225-00			TRANSISTOR:SILICON,NPN	07263	S39291
Q80	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q90	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q160	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q230	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q240	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q250	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q260	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q319	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q350	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q355	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q360	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q380	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q400	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q402	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q404	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q450	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q458	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q460	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q469	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q470	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q478	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q479	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q480	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677

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Q488	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q489	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q498	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q499	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q510	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q520	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q540	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q550	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q560	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q565	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q570	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q580	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q620	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q630	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q640	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q658	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q680	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q730	151-0104-00			TRANSISTOR:SILICON,NPN	07263	SP8481
Q740	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q750	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q760	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q790	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q820	151-1039-00			TRANSISTOR:SILICON,JFE,P-CHANNEL	80009	151-1039-00
Q840	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q860	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q880	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q885	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q900	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q905	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q920	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q930	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q950	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q960	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q965	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q980	151-0301-01			TRANSISTOR:SILICON,PNP,PRESTRESSED	80009	151-0301-01
Q990	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q1401	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q1411	151-0190-01			TRANSISTOR:SILICON,NPN	80009	151-0190-01
Q1421	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1501	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1601	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1631	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1691	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1701	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1721	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q1731	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1741	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1791	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1801	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1811	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1901	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q1911	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1921	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q1991	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3020	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3030	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3040	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q3050	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3060	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3070	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3296	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3298	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3367	151-0225-00			TRANSISTOR:SILICON,NPN	07263	S39291
Q3396	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3398	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3420	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3430	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q3440	151-1039-00			TRANSISTOR:SILICON,JFE,P-CHANNEL	80009	151-1039-00
Q3450	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q3470	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3492	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3496	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3510	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3520	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3530	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q3540	151-0269-00	B040500	B112732	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q3540	151-0269-01	B112733		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q3545	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q3580	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q3600	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3610	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q3645	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q3720	151-0292-00			TRANSISTOR:SILICON,NPN	01295	A5T5058
Q3780	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q3820	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3825	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3880	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3890	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q3920	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q4180	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4190	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4280	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4290	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4380	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4390	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4480	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q4490	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5021	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5031	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5041	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5051	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q5091	151-0224-00			TRANSISTOR:SILICON,NPN	07263	SA24850
Q5131	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5141	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q5151	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5161	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5171	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5181	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5191	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q5231	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5241	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	04713	SPS8802-1
Q5251	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5261	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5271	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q5281	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5291	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5311	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	04713	SPS8802-1
Q5331	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5341	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5351	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5361	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5371	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5381	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5391	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5431	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5441	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5451	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5461	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5471	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5481	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5491	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5511	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5521	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q5551	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q5561	151-0224-00			TRANSISTOR:SILICON,NPN	07263	SA24850
Q5571	151-0224-00			TRANSISTOR:SILICON,NPN	07263	SA24850
Q5581	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q5591	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S006075
Q5661	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5681	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S006075
Q5721	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q5731	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5741	151-0190-00	B040500	B091519	TRANSISTOR:SILICON,NPN	07263	S032677
Q5741	151-0367-00	B091520		TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	01295	SKA6516
Q5751	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q5761	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5771	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5781	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5791	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5821	151-0190-00	B040500	B091519	TRANSISTOR:SILICON,NPN	07263	S032677
Q5821	151-0367-00	B091520		TRANSISTOR:SILICON,NPN,SEL FROM 3571TP	01295	SKA6516
Q5831	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5841	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5851	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5861	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5871	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5881	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5891	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5931	151-0207-00			TRANSISTOR:SILICON,NPN	03508	X32D6191
Q5941	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5951	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q5961	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5971	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q5981	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q5991	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q6010	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6068	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6091	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6095	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6103	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S006075
Q6106	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q6149	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6162	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6164	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q6192	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q6198	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q6212	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6222	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6228	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6233	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6244	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6255	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6262	151-0341-00			TRANSISTOR:SILICON,NPN	07263	S040065
Q6266	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q6298	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6392	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6398	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q6452	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6478	151-0133-00	B040500	B112732	TRANSISTOR:SILICON,PNP	80009	151-0133-00
Q6478	151-0133-03	B112733		TRANSISTOR:2N3251,SCREENED	80009	151-0133-03
Q6482	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q6494	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6496	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6569	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6593	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6624	151-0361-00			TRANSISTOR:SILICON,NPN,DUAL	80009	151-0361-00
Q6653	151-0236-00			TRANSISTOR:SILICON,NPN	32293	ITS1074
Q6672	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q6758	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q6772	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q6786	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q6803	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6813	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6824	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6828	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q6852	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q6858	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q6877	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q7001	151-0269-00	B040500	B112732	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7001	151-0269-01	B112733		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7191	151-0325-00	B040500	B112453	TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
Q7191	151-0325-01	B112454		TRANSISTOR:SILICON,PNP,SEL	80009	151-0325-01
Q7221	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7241	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7251	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7321	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7331	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7431	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
Q7443	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7481	151-0269-00	B040500	B112732	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7481	151-0269-01	B112733		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7531	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7571	151-0269-00	B040500	B112732	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q7571	151-0269-01	B112733		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q7630	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7711	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q7763	151-0236-00			TRANSISTOR:SILICON,NPN	32293	ITS1074
Q7771	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q7781	151-0271-00			TRANSISTOR:SILICON,PNP	04713	SPS8236
Q7783	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q7811	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q7911	151-0220-00			TRANSISTOR:SILICON,PNP	07263	S036228
Q7921	151-0103-00			TRANSISTOR:SILICON,NPN	80009	151-0103-00
Q7961	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q7971	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q7981	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q8003	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8035	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
Q8133	151-0236-00			TRANSISTOR:SILICON,NPN	32293	ITS1074
Q8227	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	07263	SP12141
Q8230	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	07263	SP12141
Q8333	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	07263	SP12141
Q8455	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8479	151-0207-00			TRANSISTOR:SILICON,NPN	03508	X32D6191
Q8483	151-0207-00			TRANSISTOR:SILICON,NPN	03508	X32D6191
Q8485	151-0207-00			TRANSISTOR:SILICON,NPN	03508	X32D6191
Q8551	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8577	151-0207-00			TRANSISTOR:SILICON,NPN	03508	X32D6191
Q8605	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8701	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8703	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8739	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8755	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8781	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8837	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q8851	151-0269-00	B040500	B112732	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q8851	151-0269-01	B112733		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q8857	151-0269-00	B040500	B112732	TRANSISTOR:SILICON,NPN,SEL FROM SE3005	07263	FMT5092
Q8857	151-0269-01	B112733		TRANSISTOR:SILICON,NPN,SCREENED	80009	151-0269-01
Q8889	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q8903	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
Q8927	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q8937	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
Q9035	151-0140-00			TRANSISTOR:SILICON,NPN	02735	36568
Q9055	151-0140-00			TRANSISTOR:SILICON,NPN	02735	36568
Q9083	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9084	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9085	151-0140-00			TRANSISTOR:SILICON,NPN	02735	36568
Q9800	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q9802	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9804	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9806	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9830	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q9832	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9834	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9836	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9850	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q9852	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
Q9854	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
Q9856	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
R3	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R7	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R12	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R30	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F

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R32	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R36	321-0105-00			RES.,FXD,FILM:121 OHM,1%,0.125W	91637	MFF1816G121R0F
R40	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R45	321-0275-00			RES.,FXD,FILM:7.15K OHM,1%,0.125W	91637	MFF1816G71500F
R50	322-0085-00			RES.,FXD,FILM:75 OHM,1%,0.25W	75042	CEBT0-75R00F
R52	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R54	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R56	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R57	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R59	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R60	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0.125W	91637	MFF1816G17401F
R62	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R64	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R66	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R70	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R74	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R84	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R86	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R134	321-0210-00	B040500	B112449	RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R134	321-0215-00	B112450		RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
R138	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R140	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R150	311-1224-00			RES.,VAR,NONWIR:500 OHM,20%,0.50W	32997	3386F-T04-501
R151	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R152	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R155	321-0293-00			RES.,FXD,FILM:11K OHM,1%,0.125W	91637	MFF1816G11001F
R158	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R160	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R162	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R190	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R235	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	91637	MFF1816G36500F
R240	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R245	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R250	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	32997	3386F-T04-102
R255	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R260	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R280	322-0085-00			RES.,FXD,FILM:75 OHM,1%,0.25W	75042	CEBT0-75R00F
R285	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R289	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R301	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R329	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R335	321-0314-00			RES.,FXD,FILM:18.2K OHM,1%,0.125W	91637	MFF1816G18201F
R336	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R337	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R339	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R350	311-1227-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	32997	3386F-T04-502
R352	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R354	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R356	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R361	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R362	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R380	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R385	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R388	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R401	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R402	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R403	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725

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R404	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R405	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R406	321-0293-00	B040500	B050559	RES.,FXD,FILM:11K OHM,1%,0.125W	91637	MFF1816G11001F
R406	321-0308-00	B050560	B112724	RES.,FXD,FILM:15.8K OHM,1%,0.125W	91637	MFF1816G15801F
R406	321-0293-00	B112725		RES.,FXD,FILM:11K OHM,1%,0.125W	91637	MFF1816G11001F
R407	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R408	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R409	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R410	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R411	321-0306-00	B040500	B050559	RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R411	321-0307-00	B050560		RES.,FXD,FILM:15.4K OHM,1%,0.125W	91637	MFF1816G15401F
R438	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R448	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R449	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R450	311-1223-00			RES.,VAR,NONWIR:TRMR,250 OHM,0.5W	02111	63M251T602
R451	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R452	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R455	311-1227-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	32997	3386F-T04-502
R456	321-0293-00			RES.,FXD,FILM:11K OHM,1%,0.125W	91637	MFF1816G11001F
R458	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R460	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R461	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R466	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R467	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R468	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R471	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R474	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R475	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
R476	311-1227-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	32997	3386F-T04-502
R477	321-0366-00			RES.,FXD,FILM:63.4K OHM,1%,0.125W	91637	MFF1816G63401F
R478	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R481	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R482	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R484	311-1226-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	32997	3386F-T04-252
R485	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	91637	MFF1816G24901F
R488	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R490	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R491	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R492	311-1227-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	32997	3386F-T04-502
R493	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R494	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
R495	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
R501	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R504	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	91637	MFF1816G665R0F
R505	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	32997	3329P-L58-501
R512	321-0157-00			RES.,FXD,FILM:422 OHM,1%,0.125W	91637	MFF1816G422R0F
R520	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R526	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R528	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R530	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R550	321-0152-00			RES.,FXD,FILM:374 OHM,1%,0.125W	91637	MFF1816G374R0F
R552	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R553	321-0296-00			RES.,FXD,FILM:11.8K OHM,1%,0.125W	91637	MFF1816G11801F
R555	321-0085-01			RES.,FXD,FILM:75 OHM,0.5%,0.125W	24546	NA55D75R0D
R562	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R566	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	91637	MFF1816G31600F
R576	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925

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R583	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R586	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R587	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R588	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R592	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R594	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R596	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R597	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R598	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R612	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R618	315-0106-00			RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R619	301-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.50W	01121	EB6815
R625	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R627	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R630	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R642	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R654	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R658	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R659	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R662	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R666	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R668	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R670	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R674	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,Q.25W	01121	CB1015
R676	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R677	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R684	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R690	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R692	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R693	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R694	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R698	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R707	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R710	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R711	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R713	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R714	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R716	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R718	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R720	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R735	311-1272-00			RES.,VAR,NONWIR:100K OHM,10%,0.50W	32997	3329P-L58-104
R740	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R748	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R749	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R750	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R754	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R756	321-0178-00			RES.,FXD,FILM:698 OHM,1%,0.125W	91637	MFF1816G698R0F
R757	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R759	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R765	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R766	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R770	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R772	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R773	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R774	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R775	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R785	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R786	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R790	301-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.50W	01121	EB8215
R797	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R806	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R808	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R817	321-0372-00			RES.,FXD,FILM:73.2K OHM,1%,0.125W	91637	MFF1816G73201F
R819	321-0374-00			RES.,FXD,FILM:76.8K OHM,1%,0.125W	91637	MFF1816G76801F
R820	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R821	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R840	321-0238-00			RES.,FXD,FILM:2.94K OHM,1%,0.125W	91637	MFF1816G29400F
R842	321-0165-00			RES.,FXD,FILM:511 OHM,1%,0.125W	91637	MFF1816G511R0F
R843	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R845	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R847	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R848	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R849	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R850	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R854	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R856	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R862	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R863	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R868	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R870	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	91637	MFF1816G590R0F
R872	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R874	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R876	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R883	301-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.50W	01121	EB1225
R888	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R890	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R893	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R895	311-1261-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	32997	3329P-L58-501
R896	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R897	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R898	301-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.50W	01121	EB8215
R906	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R908	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R910	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R912	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R915	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R917	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R919	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R920	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R926	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R928	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R940	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R942	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R943	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R950	321-0178-00			RES.,FXD,FILM:698 OHM,1%,0.125W	91637	MFF1816G698R0F
R952	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R954	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R955	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R957	321-0238-00			RES.,FXD,FILM:2.94K OHM,1%,0.125W	91637	MFF1816G29400F
R958	321-0165-00			RES.,FXD,FILM:511 OHM,1%,0.125W	91637	MFF1816G511R0F
R959	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R965	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R966	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R969	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215

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R970	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R971	321-0612-03			RES.,FXD,FILM:500 OHM,0.25%,0.125W	91637	MFF1816D500R0C
R972	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R973	321-0131-00			RES.,FXD,FILM:226 OHM,1%,0.125W	91637	MFF1816G226R0F
R975	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R976	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R977	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R978	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R979	301-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.50W	01121	EB1225
R985	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R993	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R994	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R995	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R996	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R997	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R1000	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1098	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1350	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1365	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1395	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1400	315-0185-00			RES.,FXD,CMPSN:1.8M OHM,5%,0.25W	01121	CB1855
R1401	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1420	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1430	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1501	315-0275-00			RES.,FXD,CMPSN:2.7M OHM,5%,0.25W	01121	CB2755
R1502	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1520	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1530	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1601	321-0255-00			RES.,FXD,FILM:4.42K OHM,1%,0.125W	91637	MFF1816G44200F
R1602	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	91637	MFF1816G63400F
R1630	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R1631	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1632	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R1650	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1655	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R1695	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R1701	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R1710	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1715	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1720	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1721	315-0124-00			RES.,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R1725	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1730	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R1732	315-0155-00			RES.,FXD,CMPSN:1.5M OHM,5%,0.25W	01121	CB1555
R1735	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1740	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1750	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R1755	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R1760	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1791	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1793	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1795	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R1798	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R1799	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R1805	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R1810	321-0255-00			RES.,FXD,FILM:4.42K OHM,1%,0.125W	91637	MFF1816G44200F
R1820	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	91637	MFF1816G63400F

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R1830	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1835	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R1840	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1890	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1893	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0.125W	91637	MFF1816G17401F
R1900	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R1903	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R1930	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R1935	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1940	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1950	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1955	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1988	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R1990	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1991	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1998	315-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R2662	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R2701	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2706	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2710	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2715	311-0633-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	82-30-1
R2720	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R2724	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R2734	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R2820	321-0318-00	B040500	B081409	RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R2820	315-0183-00	B081410		RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R2821	311-1862-00	XB081410		RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	82-102-1
R2882	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2910	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2915	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2918	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R2920	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2922	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2932	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2934	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2970	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2978	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R2980	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3015	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3042	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3044	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3061	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3074	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R3076	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R3084	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R3086	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R3110	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R3114	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R3120	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R3122	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R3124	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R3128	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R3148	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3160	321-0327-00			RES.,FXD,FILM:24.9K OHM,1%,0.125W	91637	MFF1816G24901F
R3164	321-0309-00			RES.,FXD,FILM:16.2K OHM,1%,0.125W	91637	MFF1816G16201F
R3166	321-0355-00			RES.,FXD,FILM:48.7K OHM,1%,0.125W	91637	MFF1816G48701F
R3168	321-0301-00			RES.,FXD,FILM:13.3K OHM,1%,0.125W	91637	MFF1816G13301F

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R3174	311-0633-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	82-30-1
R3176	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R3184	311-0633-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	82-30-1
R3186	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R3196	311-0633-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	82-30-1
R3198	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R3260	321-0296-00			RES.,FXD,FILM:11.8K OHM,1%,0.125W	91637	MFF1816G11801F
R3264	321-0372-00			RES.,FXD,FILM:73.2K OHM,1%,0.125W	91637	MFF1816G73201F
R3265	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R3267	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R3269	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R3274	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
R3284	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R3290	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R3293	321-0369-00			RES.,FXD,FILM:68.1K OHM,1%,0.125W	91637	MFF1816G68101F
R3295	321-0326-00			RES.,FXD,FILM:24.3K OHM,1%,0.125W	91637	MFF1816G24301F
R3310	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3311	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R3337	321-0352-00			RES.,FXD,FILM:45.3K OHM,1%,0.125W	91637	MFF1816G45301F
R3358	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3363	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3365	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3369	311-0607-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	82-25-2
R3393	321-0369-00			RES.,FXD,FILM:68.1K OHM,1%,0.125W	91637	MFF1816G68101F
R3395	321-0298-00			RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816G12401F
R3410	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R3411	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3420	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R3431	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3450	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3451	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R3453	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R3481	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3490	321-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.125W	91637	MFF1816G22101F
R3491	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3511	321-0216-00			RES.,FXD,FILM:1.74K OHM,1%,0.125W	91637	MFF1816G17400F
R3513	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R3515	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R3517	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3521	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3523	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3531	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R3541	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R3553	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3555	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R3557	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R3581	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3583	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3585	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R3610	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3616	311-1230-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	32997	3386F-T04-203
R3621	321-0353-00			RES.,FXD,FILM:46.4K OHM,1%,0.125W	91637	MFF1816G46401F
R3623	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3625	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3641	321-0297-00			RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
R3661	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3663	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725

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R3671	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3711	321-0262-00			RES.,FXD,FILM:5.23K OHM,1%,0.125W	91637	MFF1816G52300F
R3713	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3791	316-0335-00			RES.,FXD,CMPSN:3.3M OHM,10%,0.25W	01121	CB3351
R3793	316-0335-00			RES.,FXD,CMPSN:3.3M OHM,10%,0.25W	01121	CB3351
R3795	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3811	321-0266-00			RES.,FXD,FILM:5.76K OHM,1%,0.125W	91637	MFF1816G57600F
R3813	321-0358-00			RES.,FXD,FILM:52.3K OHM,1%,0.125W	91637	MFF1816G52301F
R3814	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3840	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3890	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R3911	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3913	321-0262-00			RES.,FXD,FILM:5.23K OHM,1%,0.125W	91637	MFF1816G52300F
R3961	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3993	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3995	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3997	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4174	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4184	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4188	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4250	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4254	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4260	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4270	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4271	315-0201-00	XB112570		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R4272	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4280	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4290	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4370	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4390	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4468	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4470	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4484	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4486	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4488	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R4550	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4571	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4622	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4642	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4644	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4662	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R4728	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4768	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4772	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4776	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4780	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4786	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4920	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4922	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4960	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4996	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5018	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5020	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5022	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R5030	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R5033	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5042	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535

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R5044	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R5046	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5049	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R5050	315-0430-00			RES.,FXD,CMPSN:43 OHM,5%,0.25W	01121	CB4305
R5052	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5055	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R5060	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R5065	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R5070	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R5074	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5075	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R5076	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5080	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R5081	315-0914-00			RES.,FXD,CMPSN:910K OHM,5%,0.25W	01121	CB9145
R5089	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5115	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R5131	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5135	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R5138	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R5140	315-0433-00	B040500	B081409	RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R5140	315-0273-00	B081410		RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R5157	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5155	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R5160	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	91637	MFF1816G32401F
R5162	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R5165	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5175	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5178	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R5185	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R5193	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R5215	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5218	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R5220	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5240	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5245	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5247	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R5249	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5260	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5265	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R5268	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R5269	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5270	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5285	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5315	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5325	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R5345	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5348	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5350	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R5355	321-0281-00			RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R5357	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R5360	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5362	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5370	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5375	315-0623-00			RES.,FXD,CMPSN:62K OHM,5%,0.25W	01121	CB6235
R5380	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5385	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5398	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035

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R5401	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R5420	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5425	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5430	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R5440	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5442	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5455	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R5461	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5465	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5470	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5472	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5474	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5476	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5490	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5520	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
R5525	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R5530	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5540	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R5542	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R5545	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5550	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5560	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5562	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5570	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5575	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R5580	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5582	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R5584	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5590	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5595	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5610	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R5618	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5635	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5640	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R5642	315-0363-00			RES.,FXD,CMPSN:36K OHM,5%,0.25W	01121	CB3635
R5665	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5670	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5672	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5685	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5701	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R5710	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5720	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5722	315-0433-00			RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R5735	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R5740	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R5742	315-0754-00			RES.,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
R5744	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5746	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R5750	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R5755	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5758	316-0825-00			RES.,FXD,CMPSN:8.2M OHM,10%,0.25W	01121	CB8251
R5760	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5770	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5772	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R5775	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5780	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R5781	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915

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R5784	321-0371-00			RES.,FXD,FILM:71.5K OHM,1%,0.125W	91637	MFF1816G71501F
R5785	321-0331-00			RES.,FXD,FILM:27.4K OHM,1%,0.125W	91637	MFF1816G27401F
R5788	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R5790	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5792	321-0371-00			RES.,FXD,FILM:71.5K OHM,1%,0.125W	91637	MFF1816G71501F
R5794	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R5798	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5801	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5818	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5820	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5825	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5830	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R5832	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5834	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R5840	315-0124-00			RES.,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R5841	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R5845	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5865	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5868	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5870	315-0475-00			RES.,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
R5872	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
R5875	321-0220-00			RES.,FXD,FILM:1.91K OHM,1%,0.125W	91637	MFF1816G19100F
R5877	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R5878	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
R5880	321-0705-00			RES.,FXD,FILM:41.7K OHM,1%,0.125W	91637	MFF1816G41701F
R5882	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R5884	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
R5890	321-0331-00			RES.,FXD,FILM:27.4K OHM,1%,0.125W	91637	MFF1816G27401F
R5892	321-0705-00			RES.,FXD,FILM:41.7K OHM,1%,0.125W	91637	MFF1816G41701F
R5910	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R5920	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	91637	MFF1816G24900F
R5929	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R5933	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R5935	315-0124-00			RES.,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R5940	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5945	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R5950	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R5965	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5968	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5970	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5975	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5990	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R5994	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R5998	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	91637	MFF1816G75001F
R6005	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6008	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6071	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R6075	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R6082	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R6083	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R6086	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6098	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R6108	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6117	321-0354-00			RES.,FXD,FILM:47.5K OHM,1%,0.125W	91637	MFF1816G47501F
R6119	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R6122	321-0279-00			RES.,FXD,FILM:7.87K OHM,1%,0.125W	91637	MFF1816G78700F
R6128	321-0233-00			RES.,FXD,FILM:2.61K OHM,1%,0.125W	91637	MFF1816G26100F

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R6132	321-0247-00			RES.,FXD,FILM:3.65K OHM,1%,0.125W	91637	MFF1816G36500F
R6136	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	91637	MFF1816G23700F
R6142	321-0406-00			RES.,FXD,FILM:165K OHM,1%,0.125W	91637	MFF1816G16502F
R6144	321-0215-00			RES.,FXD,FILM:1.69K OHM,1%,0.125W	91637	MFF1816G16900F
R6148	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6152	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6154	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6158	322-0205-00			RES.,FXD,FILM:1.33K OHM,1%,0.25W	91637	MFF1421G13300F
R6164	323-0176-00			RES.,FXD,FILM:665 OHM,1%,0.50W	75042	CECT0-6650F
R6195	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R6202	311-1269-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	32997	3329P-L58-203
R6249	321-0394-00			RES.,FXD,FILM:124K OHM,1%,0.125W	91637	MFF1816G12402F
R6284	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6288	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R6304	311-1269-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	32997	3329P-L58-203
R6314	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R6324	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R6334	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6344	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6354	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R6362	311-1273-00			RES.,VAR,NONWIR:200K OHM,10%,0.5W	32997	3329P-L58-204
R6363	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R6364	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R6368	321-0829-07			RES.,FXD,FILM:202 OHM,0.1%,0.125W	91637	MFF1816C202R0B
R6370	321-0829-07			RES.,FXD,FILM:202 OHM,0.1%,0.125W	91637	MFF1816C202R0B
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R6375	SELECTED					
R6384	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R6392	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6395	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6398	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R6448	321-0130-00			RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
R6458	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R6463	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R6467	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R6468	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R6472	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R6474	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R6504	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R6506	321-0319-00			RES.,FXD,FILM:20.5K OHM,1%,0.125W	91637	MFF1816G20501F
R6508	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6512	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R6514	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
R6516	321-0219-00			RES.,FXD,FILM:1.87K OHM,1%,0.125W	91637	MFF1816G18700F
R6518	321-0240-00			RES.,FXD,FILM:3.09K OHM,1%,0.125W	91637	MFF1816G30900F
R6522	321-0182-00			RES.,FXD,FILM:768 OHM,1%,0.125W	91637	MFF1816G768R0F
R6524	321-0246-00			RES.,FXD,FILM:3.57K OHM,1%,0.125W	91637	MFF1816G35700F
R6526	321-0130-00			RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
R6528	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R6531	321-0319-00			RES.,FXD,FILM:20.5K OHM,1%,0.125W	91637	MFF1816G20501F
R6533	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6535	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R6537	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
R6539	321-0219-00			RES.,FXD,FILM:1.87K OHM,1%,0.125W	91637	MFF1816G18700F
R6542	321-0240-00			RES.,FXD,FILM:3.09K OHM,1%,0.125W	91637	MFF1816G30900F
R6544	321-0182-00			RES.,FXD,FILM:768 OHM,1%,0.125W	91637	MFF1816G768R0F
R6548	321-0246-00			RES.,FXD,FILM:3.57K OHM,1%,0.125W	91637	MFF1816G35700F

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R6552	321-0155-00			RES.,FXD,FILM:402 OHM,1%,0.125W	91637	MFF1816G402R0F
R6555	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	91637	MFF1816G45300F
R6558	321-0287-00			RES.,FXD,FILM:9.53K OHM,1%,0.125W	91637	MFF1816G95300F
R6564	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6566	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
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R6578	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6579	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R6582	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R6584	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R6586	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R6612	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6614	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6634	321-0197-00			RES.,FXD,FILM:1.1K OHM,1%,0.125W	91637	MFF1816G11000F
R6638	321-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.125W	91637	MFF1816G15800F
R6642	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R6646	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R6648	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6663	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R6668	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R6673	311-1265-00			RES.,VAR,NONWIR:2K OHM,10%,0.50W	32997	3329P-L58-202
R6677	321-0303-00			RES.,FXD,FILM:14K OHM,1%,0.125W	91637	MFF1816G14001F
R6684	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R6689	321-0300-00			RES.,FXD,FILM:13K OHM,1%,0.125W	91637	MFF1816G13001F
R6724	321-0358-00			RES.,FXD,FILM:52.3K OHM,1%,0.125W	91637	MFF1816G52301F
R6736	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R6741	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R6758	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6782	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
	----- -----			(NOMINAL VALUE, SELECTED)		
R6791	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R6793	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
	----- -----			(NOMINAL VALUE, SELECTED)		
R6798	321-0230-00			RES.,FXD,FILM:2.43K OHM,1%,0.125W	91637	MFF1816G24300F
R6833	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6836	311-1266-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	32997	3329P-L58-252
R6842	321-0271-00			RES.,FXD,FILM:6.49K OHM,1%,0.125W	91637	MFF1816G64900F
R6844	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816G32400F
R6848	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6859	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R6860	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R6864	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R6866	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R6868	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R6875	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6883	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6892	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6898	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R6904	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6910	321-0341-00			RES.,FXD,FILM:34.8K OHM,1%,0.125W	91637	MFF1816G34801F
R6912	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R6920	321-0309-00			RES.,FXD,FILM:16.2K OHM,1%,0.125W	91637	MFF1816G16201F
R6926	321-0357-00			RES.,FXD,FILM:51.1K OHM,1%,0.125W	91637	MFF1816G51101F
R6938	311-1269-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	32997	3329P-L58-203
R6942	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R6944	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R6956	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105

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R6977	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R6981	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6983	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R6992	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6996	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R7005	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7030	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R7034	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R7051	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R7131	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
R7138	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
R7143	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R7181	315-0203-00	B040500	B059999	RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R7181	315-0393-00	B060000		RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R7215	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R7236	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R7237	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R7238	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7240	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7241	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R7261	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R7331	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7333	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R7341	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7351	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R7353	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R7355	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R7357	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	32997	3386F-T04-102
R7361	311-0613-00			RES.,VAR,NONWIR:100K OHM,10%,0.50W	73138	82-27-2
R7371	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7381	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7383	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R7385	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R7441	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7443	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816G32400F
R7445	321-0305-00			RES.,FXD,FILM:14.7K OHM,1%,0.125W	91637	MFF1816G14701F
R7453	311-1227-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	32997	3386F-T04-502
R7461	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
R7491	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7492	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7541	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	91637	MFF1816G75001F
R7542	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7546	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R7551	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	91637	MFF1816G31600F
R7553	321-0241-00			RES.,FXD,FILM:3.16K OHM,1%,0.125W	91637	MFF1816G31600F
R7581	321-0269-00			RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
R7591	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7615	311-0634-00			RES.,VAR,NONWIR:TRMR,500 OHM,0.5W	32997	3326H-G48-501
R7661	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R7685	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R7691	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R7711	321-0168-00			RES.,FXD,FILM:549 OHM,1%,0.125W	91637	MFF1816G549R0F
R7721	321-0101-00			RES.,FXD,FILM:110 OHM,1%,0.125W	91637	MFF1816G110R0F
R7723	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R7725	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R7727	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R7729	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F

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R7731	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R7733	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R7735	311-1223-00			RES.,VAR,NONWIR:TRMR,250 OHM,0.5W	02111	63M251T602
R7751	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W	91637	MFF1816G66500F
R7761	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R7763	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R7781	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7841	321-0219-00			RES.,FXD,FILM:1.87K OHM,1%,0.125W	91637	MFF1816G18700F
R7843	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R7851	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R7853	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R7891	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7893	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R7901	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R7911	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R7912	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R7913	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R7915	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R7921	308-0252-00			RES.,FXD,WW:390 OHM,5%,3W	91637	CW2B-B390R0J
R7923	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7931	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7933	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7935	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7941	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7943	321-0114-07			RES.,FXD,FILM:150 OHM,0.1%,0.125W	91637	MFF1816C150R0B
R7951	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7953	301-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.50W	01121	EB8215
R7955	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R7961	321-0105-00			RES.,FXD,FILM:121 OHM,1%,0.125W	91637	MFF1816G121R0F
R7963	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R7971	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7973	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R7981	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R7983	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R7991	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R7993	311-1221-00			RES.,VAR,NONWIR:50 OHM,20%,0.50W	32997	3386F-T04-500
R7995	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8001	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R8007	311-1258-00			RES.,VAR,NONWIR:50 OHM,10%,0.50W	32997	3329P-L58-500
R8027	321-0217-03			RES.,FXD,FILM:1.78K OHM,0.25%,0.125W	91637	MFF1816D17800C
R8029	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8037	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R8053	315-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R8059	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8077	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8102	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8103	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8105	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R8107	321-0664-00			RES.,FXD,FILM:1.56K OHM,0.5%,0.125W	91637	MFF1816D15600D
R8109	311-0633-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	82-30-1
R8127	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8129	321-0829-02			RES.,FXD,FILM:202 OHM,0.5%,0.125W	91637	MFF1816D202R0D
R8135	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3329P-L58-101
R8137	321-0735-07			RES.,FXD,FILM:1.001K OHM,0.1%,0.125W	91637	MFF1816C10010B
R8139	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8141	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8145	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B

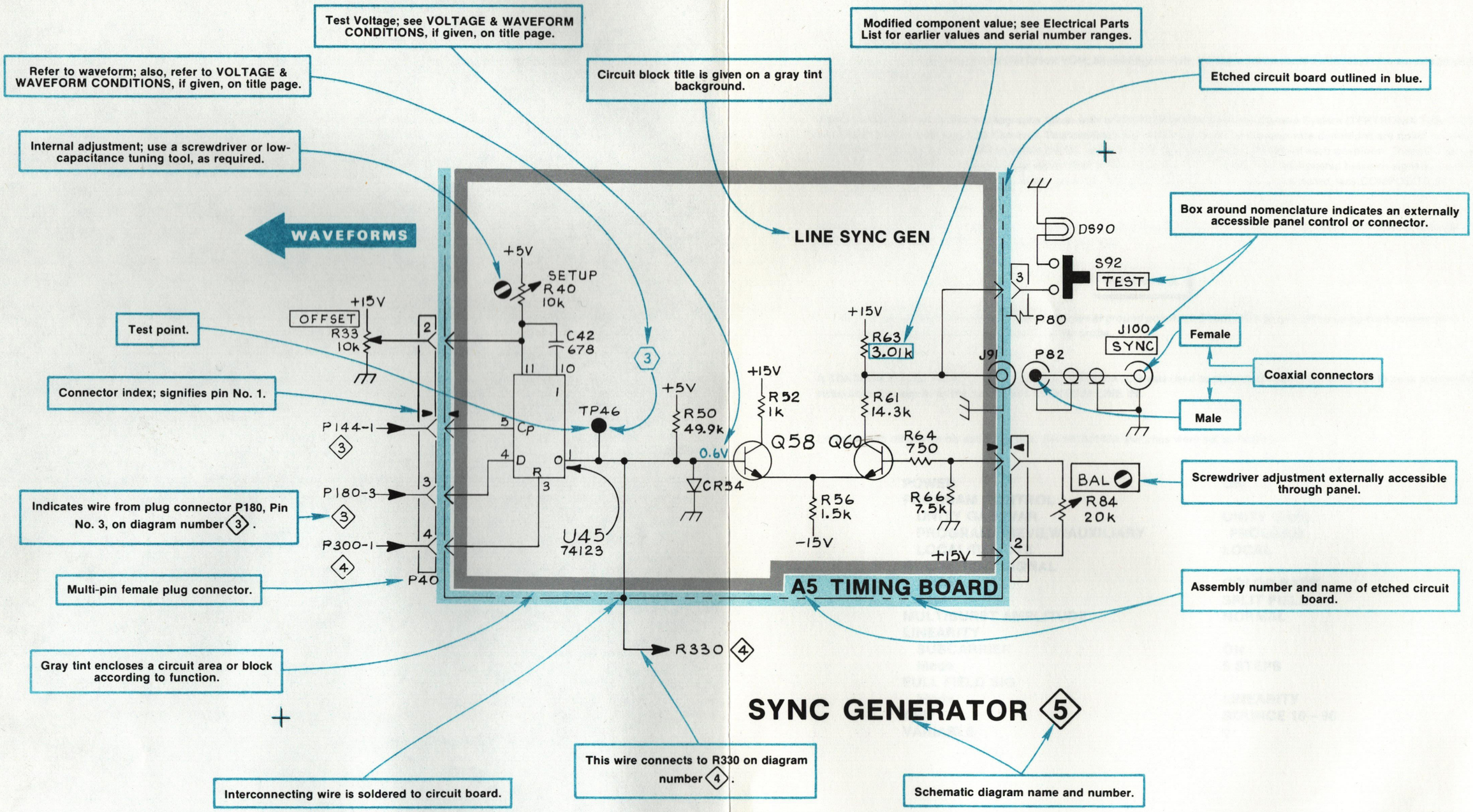
Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R8153	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8155	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8203	321-0829-02			RES.,FXD,FILM:202 OHM,0.5%,0.125W	91637	MFF1816D202R0D
R8204	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8205	321-0261-00			RES.,FXD,FILM:5.11K OHM,1%,0.125W	91637	MFF1816G51100F
R8207	321-0346-00			RES.,FXD,FILM:39.2K OHM,1%,0.125W	91637	MFF1816G39201F
R8229	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3329P-L58-101
R8230	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8231	321-0735-07			RES.,FXD,FILM:1.001K OHM,0.1%,0.125W	91637	MFF1816C10010B
R8233	321-0735-07			RES.,FXD,FILM:1.001K OHM,0.1%,0.125W	91637	MFF1816C10010B
R8235	321-0735-07			RES.,FXD,FILM:1.001K OHM,0.1%,0.125W	91637	MFF1816C10010B
R8251	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8252	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8259	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8261	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8301	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8303	321-0346-00			RES.,FXD,FILM:39.2K OHM,1%,0.125W	91637	MFF1816G39201F
R8305	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8327	321-0340-00			RES.,FXD,FILM:34K OHM,1%,0.125W	91637	MFF1816G34001F
R8330	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8331	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8335	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8337	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R8353	321-0812-07			RES.,FXD,FILM:455 OHM,0.1%,0.125W	91637	MFF1816C455R0B
R8377	321-0125-00			RES.,FXD,FILM:196 OHM,1%,0.125W	91637	MFF1816G196R0F
R8379	321-0125-00			RES.,FXD,FILM:196 OHM,1%,0.125W	91637	MFF1816G196R0F
R8413	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R8429	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8433	321-0340-00			RES.,FXD,FILM:34K OHM,1%,0.125W	91637	MFF1816G34001F
R8435	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R8451	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R8453	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R8457	321-0154-00			RES.,FXD,FILM:392 OHM,1%,0.125W	91637	MFF1816G392R0F
R8487	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R8531	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8553	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8555	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8557	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8579	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8581	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R8583	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R8585	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R8601	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8607	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R8651	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8655	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8663	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8683	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8705	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
R8707	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8709	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
R8727	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
R8731	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8735	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8737	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8753	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8777	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425

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R8779	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R8783	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R8785	321-0184-00	B040500	B050559	RES.,FXD,FILM:806 OHM,1%,0.125W	91637	MFF1816G806R0F
R8785	321-0195-00	B050560		RES.,FXD,FILM:1.05K OHM,1%,0.125W	91637	MFF1816G10500F
R8793	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R8805	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R8827	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R8831	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R8833	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8835	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8841	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R8847	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R8853	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R8855	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R8859	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8877	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R8879	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R8883	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R8885	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R8887	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R8891	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8905	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8927	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R8929	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R8939	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	32997	3386F-T04-102
R8955	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R9002	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9081	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R9083	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9086	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R9087	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R9088	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R9089	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R9090	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R9091	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R9093	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R9205	311-1182-00			RES.,VAR,NONWIR:1.5K OHM,10%,0.5W	01121	W7835
R9209	311-0326-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	01121	W7683
R9210	311-0585-00			RES.,VAR,NONWIR:15K OHM,20%,0.25W	71590	BA201-061
R9212	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R9215	311-0310-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	01121	W-7350A
R9280	311-0068-00			RES.,VAR,NONWIR:500K OHM,20%,0.50W	12697	381-CM15331
R9291	321-1170-03			RES.,FXD,FILM:583 OHM,0.25%,0.125W	91637	MFF1816D583R0C
R9292	321-0180-03			RES.,FXD,FILM:732 OHM,0.25%,0.125W	24546	NC55C7320C
R9293	321-0190-03			RES.,FXD,FILM:931 OHM,0.25%,0.125W	24546	NC55C9310C
R9294	321-0202-03			RES.,FXD,FILM:1.24K OHM,0.25%,0.125W	24546	NC55C1241C
R9295	321-1216-03			RES.,FXD,FILM:1.76K OHM,0.25%,0.125W	91637	MFF1816D17600C
R9296	321-0233-03			RES.,FXD,FILM:2.61K OHM,0.25%,0.125W	24546	NC55C2611C
R9297	321-1254-03			RES.,FXD,FILM:4.37K OHM,0.25%,0.125W	24546	NC55C4371C
R9298	321-1283-03			RES.,FXD,FILM:8.76K OHM,0.25%,0.125W	91637	MFF1816D87600C
R9299	321-1329-03			RES.,FXD,FILM:26.4K OHM,0.25%,0.125W	91637	MFF1816D26401C
R9800	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9801	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R9802	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9803	308-0344-00			RES.,FXD,WW:18.2 OHM,1%,3W	91637	RS2B-K18R20F
R9804	308-0590-00			RES.,FXD,WW:0.25 OHM,5%,3W	91637	RS2B-ER2500J
R9806	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315

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R9808	321-0197-00			RES.,FXD,FILM:1.1K OHM,1%,0.125W	91637	MFF1816G11000F
R9810	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R9812	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R9814	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9816	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9818	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R9830	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9831	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R9832	308-0245-00			RES.,FXD,WW:0.6 OHM,5%,2W	91637	CW2B30 0.60HM 5%
R9834	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9836	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R9838	321-0224-00			RES.,FXD,FILM:2.1K OHM,1%,0.125W	91637	MFF1816G21000F
R9840	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R9842	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9844	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9846	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R9848	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R9850	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R9851	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R9852	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R9854	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R9856	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	91637	MFF1816G909R0F
R9858	321-0173-00			RES.,FXD,FILM:619 OHM,1%,0.125W	91637	MFF1816G619R0F
R9860	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9862	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R9864	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9866	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9868	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9870	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R9872	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R9874	308-0245-00			RES.,FXD,WW:0.6 OHM,5%,2W	91637	CW2B30 0.60HM 5%
S9201	260-0276-00			SWITCH,TOGGLE:DPST,15A,125V	27193	7561 K 4
S9202	----- -----			(SEE MPL LINE VOLTAGE SELECTOR)		
S9203	----- -----			(SEE MPL LINE VOLTAGE SELECTOR)		
S9205	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9212	260-1248-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-1248-00
S9213	260-1249-00			SWITCH,LEVER:2 SECT,3 POSN,30 DEG	80009	260-1249-00
S9225	260-1494-00			SWITCH,LEVER:1 SECT,3 POSN,30 DEG	80009	260-1494-00
S9230	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9250	260-0664-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0664-00
S9255	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9260	260-1587-00			SWITCH,ROTARY:1 SECT,12 POSN,45 DEG	80009	260-1587-00
S9270	260-0621-00			SWITCH,LEVER:1 SECT,3 POSN,30 DEG	80009	260-0621-00
S9285	260-0731-00			SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
S9290	260-1374-00			SWITCH,ROTARY:1 SECT,12 POSN,30 DEG	80009	260-1374-00
T8061	120-0524-00			XFMR,TOROID:12 TURNS QUADFILAR	80009	120-0524-00
T8661	120-0631-00			XFMR,TOROID:10 TURN TRIFILAR	80009	120-0631-00
T9001	120-0737-00			XFMR,PWR,STPDN:	80009	120-0737-00
U21	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U101	156-0114-00			MICROCIRCUIT,DI:DIVIDE-BY-12,COUNTER	80009	156-0114-00
U201	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL,14 DIP	01295	SN74121(N OR J)
U301	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U401	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U449	156-0092-00			MICROCIRCUIT,DI:HEX INV W/OPEN COLLECTOR	80009	156-0092-00
U499	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)

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U761	155-0022-00			MICROCIRCUIT,DI:ML,CHANNEL SWITCH	80009	155-0022-00
U861	155-0022-00			MICROCIRCUIT,DI:ML,CHANNEL SWITCH	80009	155-0022-00
U1001	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1031	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1061	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1091	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1101	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U1131	156-0034-00			MICROCIRCUIT,DI:DUAL 4-INPUT NAND GATE	80009	156-0034-00
U1161	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1191	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1201	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U1231	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1261	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U1291	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1301	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U1331	156-0034-00			MICROCIRCUIT,DI:DUAL 4-INPUT NAND GATE	80009	156-0034-00
U1361	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1391	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1431	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1461	156-0047-00	B040500	B112453	MICROCIRCUIT,DI:TPL 3-INPUT POS NAND GATE	80009	156-0047-00
U1461	156-0047-02	B112454		MICROCIRCUIT,DI:TPl 3 INP,NAND GATE	27014	DM7410NA+ OR JA+
U2001	156-0078-00			MICROCIRCUIT,DI:1 OF 16 DECODER-DEMUX	80009	156-0078-00
U2061	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2081	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2261	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2281	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2401	156-0078-00			MICROCIRCUIT,DI:1 OF 16 DECODER-DEMUX	80009	156-0078-00
U2461	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2481	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2661	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2681	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2721	156-0037-00			MICROCIRCUIT,DI:2-INPUT +AND/OR/INVERT GATE	80009	156-0037-00
U2741	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U2761	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2781	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2811	156-0172-00	B040500	B112732	MICROCIRCUIT,DI:DUAL RETRIG ONE-SHOT W/CLR	80009	156-0172-00
U2811	156-0172-02	B112733		MICROCIRCUIT,DI:DUAL RETRIG MONOSTABLE MV	01295	SN74123
U2831	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U2861	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U2881	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2911	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7401N OR J
U2931	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U2961	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U2981	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7401N OR J
U3010	156-0178-00			MICROCIRCUIT,DI:TRIPLE 3-INPUT NOR GATE	01295	SN7427N
U3210	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U3220	156-0089-00			MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER	80009	156-0089-00
U3230	156-0089-00			MICROCIRCUIT,DI:4-BIT UP/DOWN COUNTER	80009	156-0089-00
U3585	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U3735	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U3755	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U3775	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U3835	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U3855	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U3875	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4151	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4171	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U4271	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U4351	156-0078-00			MICROCIRCUIT,DI:1 OF 16 DECODER-DEMUX	80009	156-0078-00
U4471	156-0032-00			MICROCIRCUIT,DI:4-BIT BINARY COUNTER	80009	156-0032-00
U4551	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4571	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U4621	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4622	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4641	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4642	156-0145-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND BFR	80009	156-0145-00
U4661	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4662	156-0079-00			MICROCIRCUIT,DI:DECADE COUNTER,TTL	80009	156-0079-00
U4681	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4721	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U4741	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4761	156-0047-00	B040500	B112453	MICROCIRCUIT,DI:TPL 3-INPUT POS NAND GATE	80009	156-0047-00
U4761	156-0047-02	B112454		MICROCIRCUIT,DI:TPl 3 INP,NAND GATE	27014	DM7410NA+ OR JA+
U4781	156-0058-00			MICROCIRCUIT,DI:HEX.INVERTER	80009	156-0058-00
U4821	156-0035-00			MICROCIRCUIT,DI:SGL 8-INPUT POS NAND GATE	80009	156-0035-00
U4841	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
U4861	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U4881	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7400(N OR J)
U6170	156-0048-00			MICROCIRCUIT,LI:FIVE NPN TRANSISTOR ARRAY	02735	CA3046
U7251	156-0057-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN7401N OR J
U7291	156-0067-00	B040500	B091769	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	01295	MICROA741CP
U7291	156-0067-12	B091770		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	01295	UA741CJG
U8151	156-0130-00	B040500	B112732	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR	80009	156-0130-00
U8151	156-0130-02	B112733		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN	04713	SC77162GH
U8255	156-0130-00	B040500	B112732	MICROCIRCUIT,LI:MODULATOR/DEMODULATOR	80009	156-0130-00
U8255	156-0130-02	B112733		MICROCIRCUIT,LI:MODULATOR/DEMODULATOR,SCRN	04713	SC77162GH
U8977	156-0043-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NOR GATE	80009	156-0043-00
VR6484	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
VR7161	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR8054	152-0217-00			SEMICOND DEVICE:ZENER,0.4W,8.2V,5%	04713	SZG20
VR8355	152-0123-00			SEMICOND DEVICE:ZENER,0.5W,9V,5%	04713	SZ11530RL
VR9850	152-0212-00			SEMICOND DEVICE:ZENER,0.5W,9V,5%	04713	SZ50646RL
Y5639	158-0069-00			XTAL UNIT,QTZ:3.579545 MHZ,+/-0.0035%	75378	TX-005



2029-32

SCHEMATIC EXAMPLE

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

This section of the manual contains block and schematic diagrams with waveforms and etched circuit board illustrations.

Symbols

Symbols used on the diagrams are based on ANSI Y32.2-1970 and IEEE No. 315 March 1971. Logic symbology is based on ANSI Y32.14-1973 (IEEE Std. 91-1973). Logic symbols depict the logic function performed and may differ from the manufacturer's data.

Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF). Values less than one are in micofarads (μF).

Resistors = Ohms (Ω).

Semiconductor Types

Refer to the Electrical Parts List.

Reference Designators

The following letters are used as reference designators to identify components or assemblies on Tektronix, Inc. schematic diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CR	Diode, signal or rectifier
DH	Decoupling Hybrid
DL	Delay Line
DS	Indicating device (lamp)
E, SG	Spark Gap
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
P	Connector, movable portion
Q	Transistor, silicon-controlled rectifier, or programmable unijunction transistor
R	Resistor, fixed or variable
RT	Thermistors
S	Switch
T	Transformer
TC	Thermocouple
TP	Test Point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal

Partial Schematic Diagram With Explanations

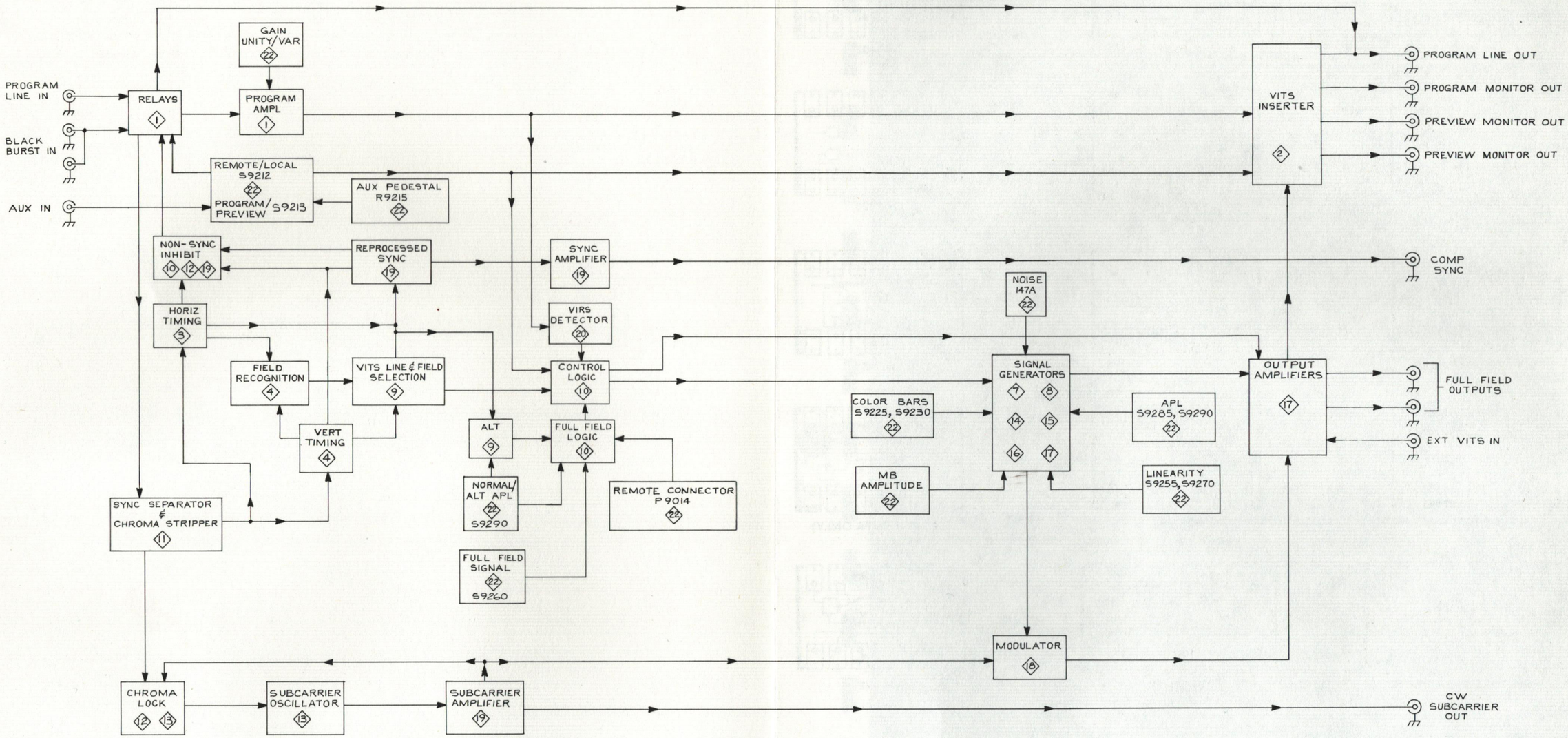
The partial diagram at the left is an example of the various symbols and other information provided on Tektronix, Inc. diagrams.

Transformer Wiring

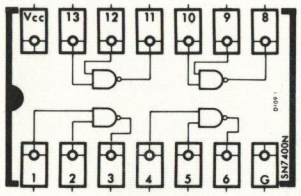
A two-letter abbreviation color code is used to identify wires without terminal connection labels.

Bk	Black
Br	Brown
Rd	Red
Or	Orange
Yl	Yellow
G	Green
Bl	Blue
Vi	Violet
Gy	Gray
W	White

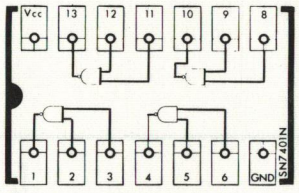
@


PROGRAM LINE IN
BLACK BURST IN
AUX IN
RELAYS 1
GAIN UNITY/VAR 22
PROGRAM AMPL 1
REMOTE/LOCAL S9212 22
PROGRAM/PREVIEW S9213
AUX PEDESTAL R9215 22
NON-SYNC INHIBIT 10 12 19
REPROCESSED SYNC 19
SYNC AMPLIFIER 19
HORIZ TIMING 3
VIRS DETECTOR 20
FIELD RECOGNITION 4
VITS LINE & FIELD SELECTION 9
CONTROL LOGIC 10
VERT TIMING 4
ALT 9
FULL FIELD LOGIC 10
NORMAL/ALT APL 22 S9290
REMOTE CONNECTOR P9014 22
FULL FIELD SIGNAL 22 S9260
SYNC SEPARATOR & CHROMA STRIPPER 11
NOISE 147A 22
SIGNAL GENERATORS 7 8 14 15 16 17
COLOR BARS S9225, S9230 22
APL S9285, S9290 22
MB AMPLITUDE 22
LINEARITY S9255, S9270 22
VITS INSERTER 2
OUTPUT AMPLIFIERS 17
PROGRAM LINE OUT
PROGRAM MONITOR OUT
PREVIEW MONITOR OUT
PREVIEW MONITOR OUT
COMP SYNC
FULL FIELD OUTPUTS
EXT VITS IN
MODULATOR 18
CHROMA LOCK 12 13
SUBCARRIER OSCILLATOR 13
SUBCARRIER AMPLIFIER 19
CW SUBCARRIER OUT

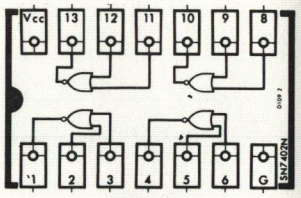
IC DIAGRAMS



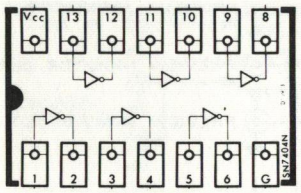
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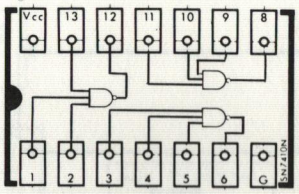
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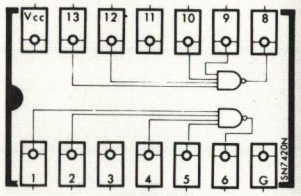
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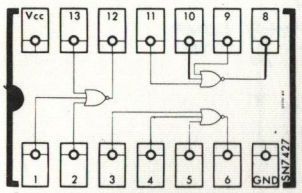
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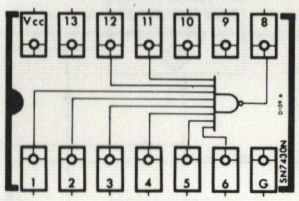
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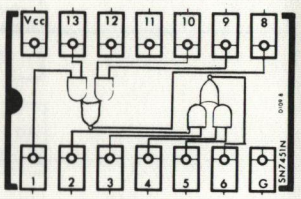
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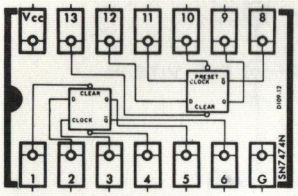
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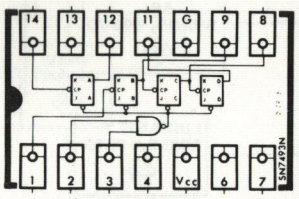
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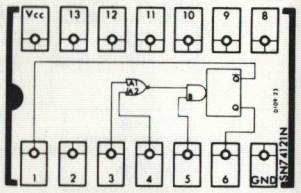
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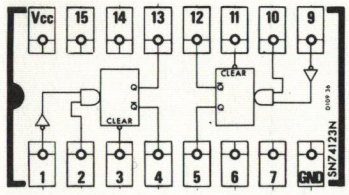
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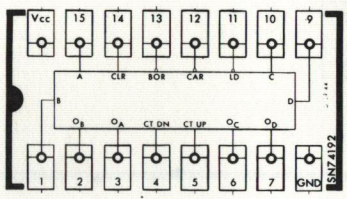
SN 7493



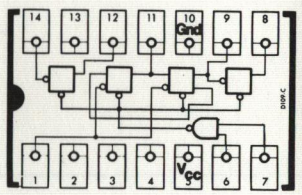
SN 74121 (147A ONLY)



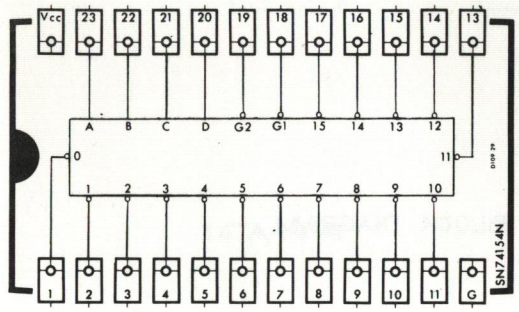
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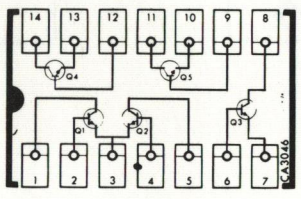
SN 74192



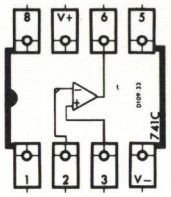
SN 7492



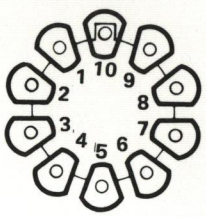
SN 74154



CA 3046



μA 741C

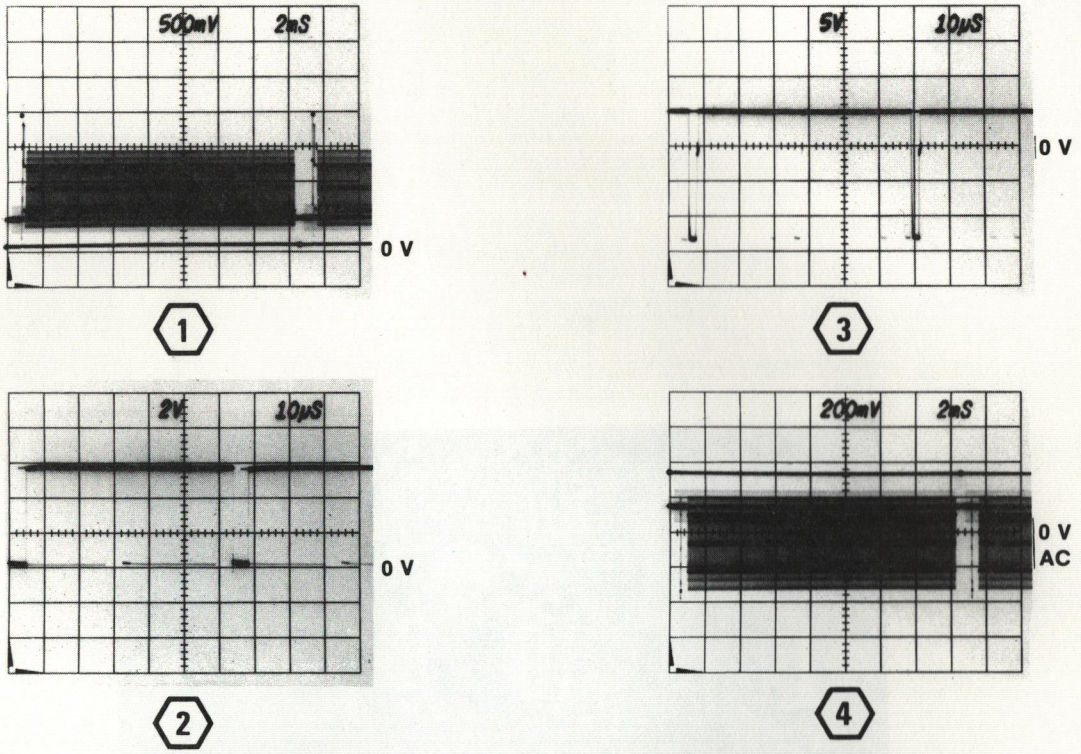


1. + Signal Input
2. Gain Adjust
3. Gain Adjust
4. − Signal Input
5. Bias
6. + Output
7. + Carrier Input
8. − Carrier Input
9. − Output
10. V^-

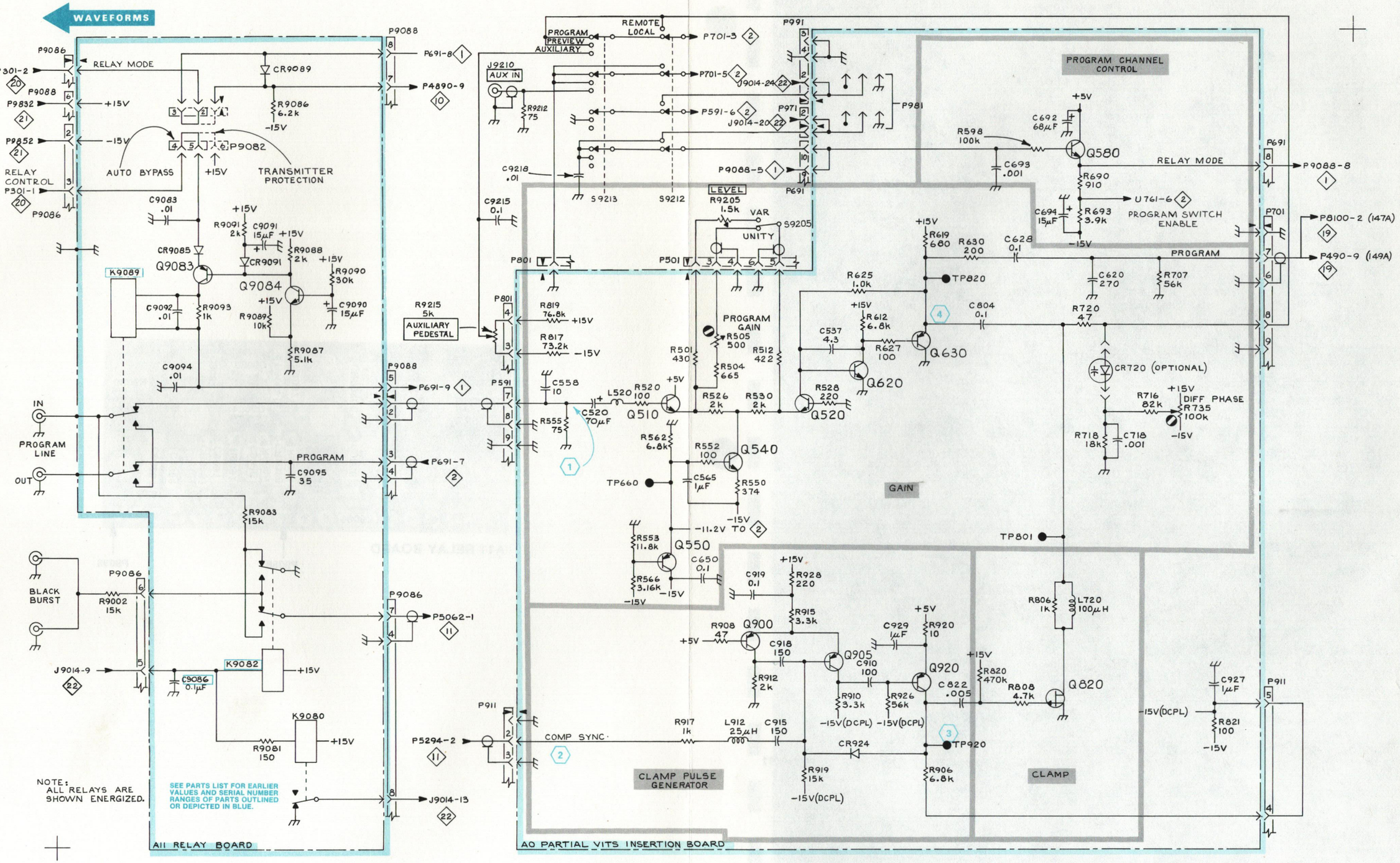
MC 1496

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1 WAVEFORMS



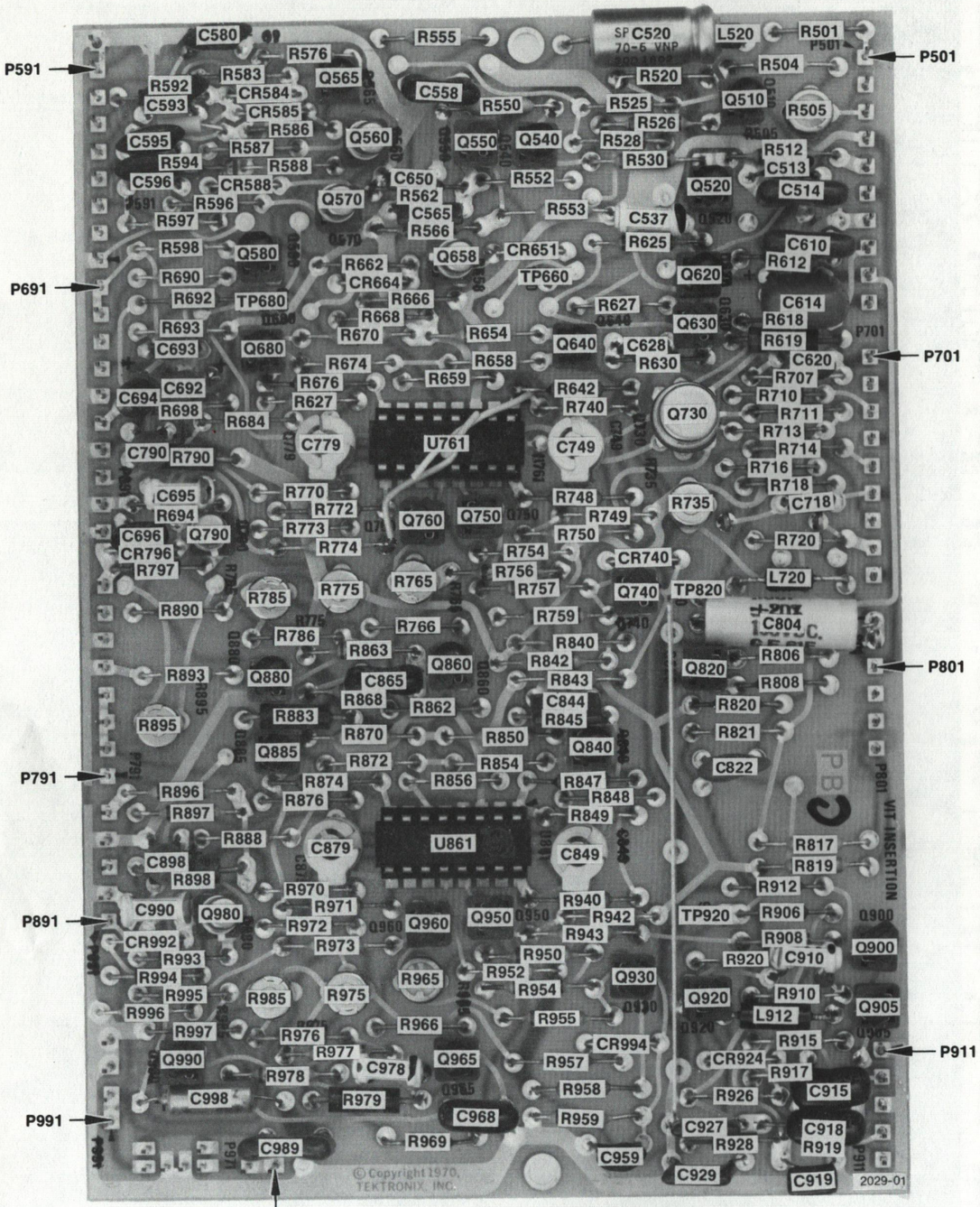
Waveforms and Voltages obtained under conditions given on the Diagram Title page.



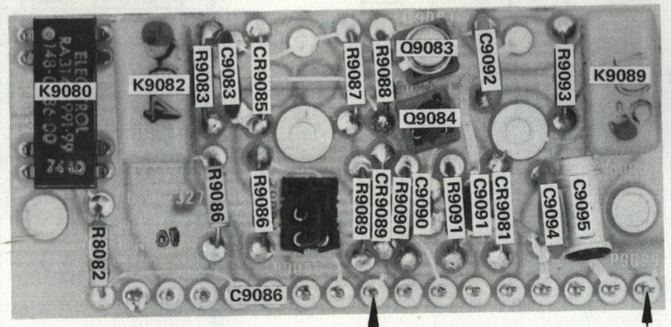
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147A/149A

PROGRAM LINE AMPLIFIER 1

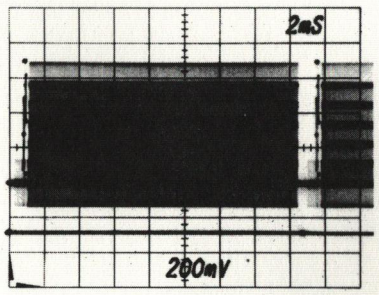


A0 VITS INSERTION BOARD

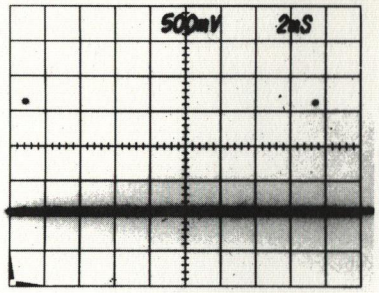


A11 RELAY BOARD

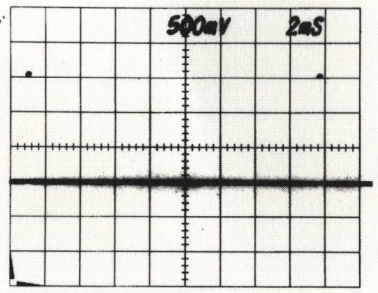
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WAVEFORMS



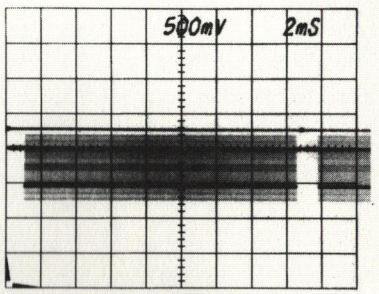
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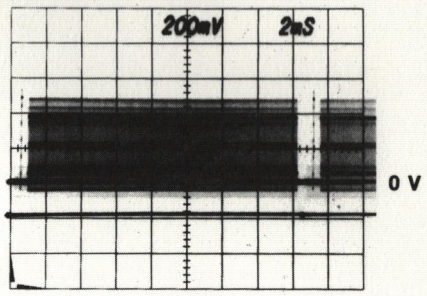
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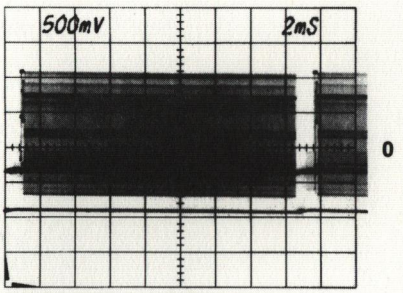
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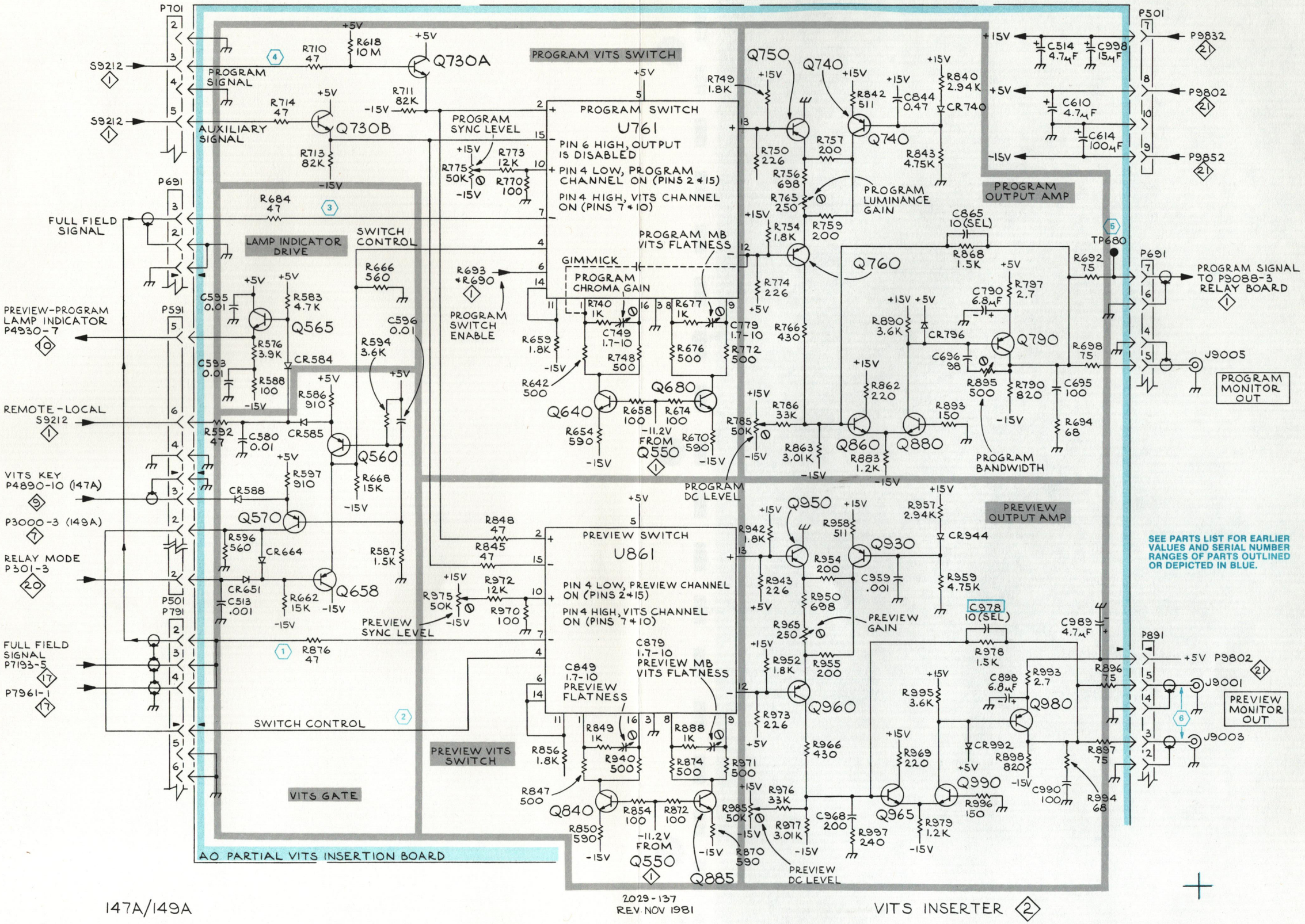


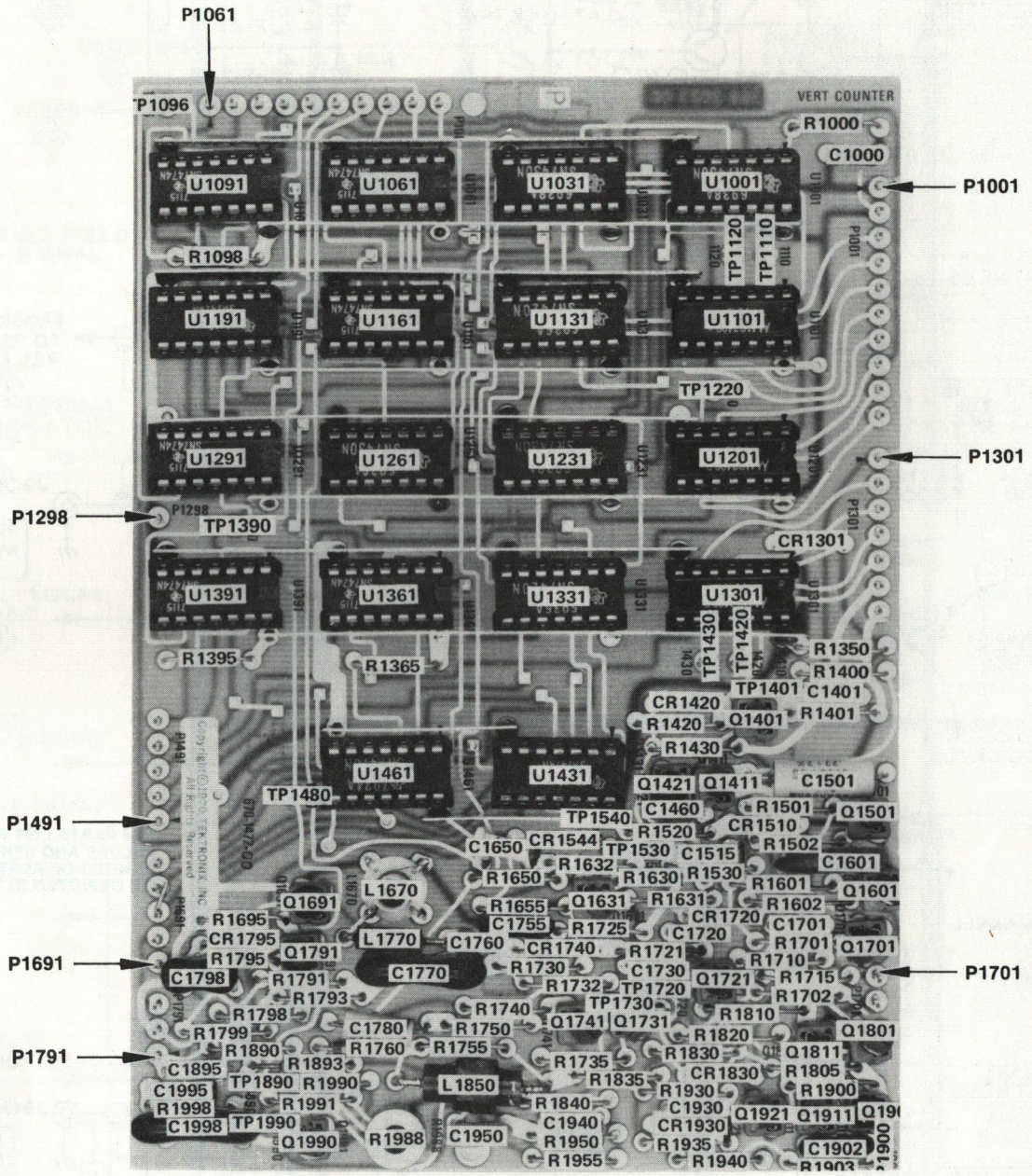
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6

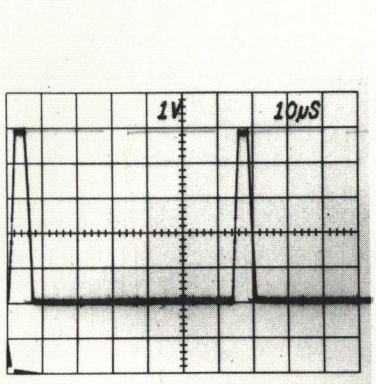
Waveforms and Voltages obtained under conditions given on the Diagram Title page.


PROGRAM VITS SWITCH
PROGRAM SWITCH
U761
PIN 6 HIGH, OUTPUT IS DISABLED
PIN 4 LOW, PROGRAM CHANNEL ON (PINS 2 & 15)
PIN 4 HIGH, VITS CHANNEL ON (PINS 7 & 10)
PROGRAM SYNC LEVEL
PROGRAM MB VITS FLATNESS
GIMMICK
PROGRAM CHROMA GAIN
PROGRAM SWITCH ENABLE
PROGRAM DC LEVEL
PROGRAM OUTPUT AMP
PROGRAM LUMINANCE GAIN
PROGRAM SIGNAL
AUXILIARY SIGNAL
FULL FIELD SIGNAL
LAMP INDICATOR DRIVE
SWITCH CONTROL
PREVIEW-PROGRAM LAMP INDICATOR P4930-7
REMOTE-LOCAL S9212
VITS KEY P4890-10 (147A)
P3000-3 (149A)
RELAY MODE P301-3
P7961-1
PREVIEW SWITCH
U861
PIN 4 LOW, PREVIEW CHANNEL ON (PINS 2 & 15)
PIN 4 HIGH, VITS CHANNEL ON (PINS 7 & 10)
PREVIEW SYNC LEVEL
C879 1.7-10 PREVIEW MB VITS FLATNESS
C849 1.7-10 PREVIEW FLATNESS
PREVIEW VITS SWITCH
PREVIEW OUTPUT AMP
PREVIEW GAIN
PREVIEW DC LEVEL
VITS GATE
PROGRAM BANDWIDTH
PROGRAM SIGNAL TO P9088-3 RELAY BOARD
PROGRAM MONITOR OUT
PREVIEW MONITOR OUT
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.
A0 PARTIAL VITS INSERTION BOARD
-11.2V FROM Q550
2029-137 REV NOV 1981
147A/149A
VITS INSERTER 2
VITS INSERTER 2

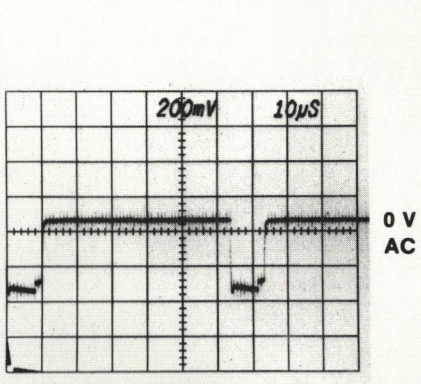


A1 VERT COUNTER BOARD

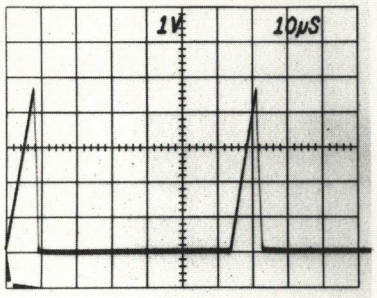
3 WAVEFORMS



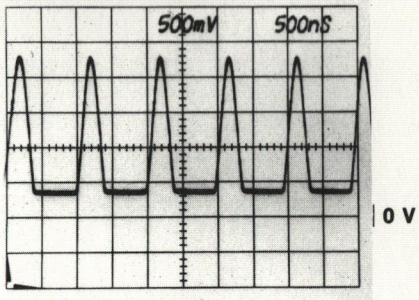
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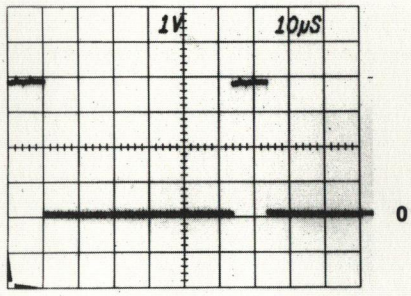
3



2



4



5

Waveforms and Voltages obtained under conditions given on the Diagram Title page.

WAVEFORMS

HORIZONTAL INTEGRATOR

PHASE DETECTOR

1 MHz OSCILLATOR

÷64 COUNTER

VITS H BLANKING

P1298

P1701

FROM P5294-3 11

COMPOSITE SYNC

R1715 2.2k

R1720 15k

R1820 6.34k

-15V

TO R1710 4

Q1801

Q1811

+5V

R1805 11k

R1900 4.3k

+15V

R1903 2.7k

Q1901

1

TP1900

C1902 450

Q1911

R1810 4.42k

TP1720

Q1721

C1730 .02

R1725 47k

R1721 120k

C1720 1000

C1755 180

CR1740

R1730 470k

C1760 0.1

L1770 25μH

C1770 .01

R1732 1.5M

R1793 33k

R1791 10k

-15V

+15V

C1798 1000

C1995 39

C1998 .01

R1799 22k

R1798 820

R1998 24

Q1691

Q1791

4

TP1480

1MHz ADJ

L1670 2.9-6.7μH

R1830 4.7k

CR1830

L1850 240μH

R1755 6.2k

R1835 1.2k

Q1921

CR1930

C1930 33

R1935 3.3k

R1930 150k

R1940 470

TP1730

P2000-4 5

P2000-9 5

P2000-5 5

P2000-6 5

P2000-7 5

P2000-8 5

P2400-2 5

P1491

P1691

P1791

503.5kHz

251.75kHz

125.9kHz

62.9kHz

31.5kHz

15.734KHz

15.734kHz

U1331B 7420

TP1430 5

VITS H BLANKING

P1301

U1461A 7410

VITS H BLANKING

P4960-1 9

U1301B&C 7400

R1365 1k

+5V

U1391B 7474

R1395 1k

U1391A 7474

R1695 180

U1361A 7474

U1361B 7474

U1431A 7474

U1431B 7474

+5V TO U1461B-3 4

+15V P9832 21

-15V P9852 21

P1001

+5V P9802 21

C1000 0.1

INSERT DELAY

R9209 10k

P1791

R1890 33k

C1895 .01

SYNC DELAY

R1988 10k

R1991 100

R1840 4.7k

C1950 .01

Q1731

R1955 4.7k

C1940 330

R1740 1k

R1950 47k

Q1741

R1735 3.3k

DELAY

TP1990

R1750 270

2

C1780 1500

Q1991

R1990 100

R1760 4.7k

R1893 17.4k

TP1890

3

R1795 390

CR1795

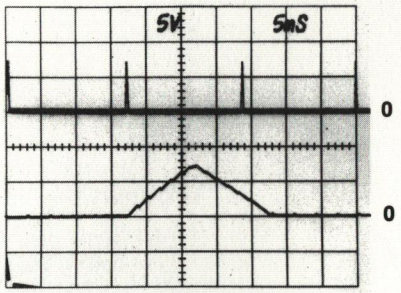
U1461C 7410

8μS

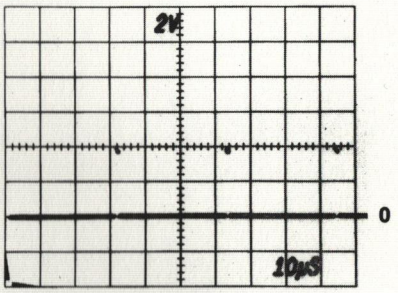
CR1544 4 TO FIELD RECOGNITION

P/O A1 HORIZ & VERT COUNTER BOARD

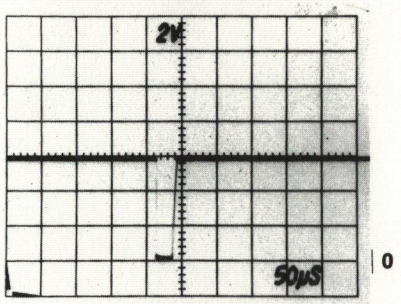
4 WAVEFORMS



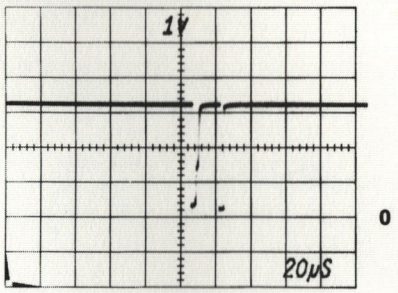
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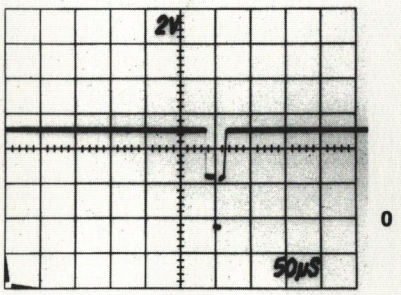
3



2



4



5

Waveforms and Voltages obtained under conditions given on the Diagram Title page.

FIELD RECOGNITION

+15V
R1401 4.7k
Q1401
+5V
TP1540
5
R1430 4.7k
-15V
CR1420
+5V R1420 10k
CR1544
U1461C-8 3
8μs LINE RATE GATE
+5V R1350 10k
C1401 1000
CR1301
+5V
TP1420
U1301A&D 7400
VERT RESET
FIELD 1
FIELD 2
P1301
P4590-1 9
P4100-2 9
P4100-3 9

MATRIX

U1201A&D 7400
U1031 7430
U1331A 7420
U1131A 7420
U1131B 7420
U1001 7430
U1231 7430
U1261 7430
U1101A&D 7400
U1101B&C 7400
U1201B&C 7400
9 LINE KEY OUT
TP1110 VERTICAL BLANKING
TP1120 FIELD SQ.WAVE
TP1220
5,8 WINDOW
R1000 1k
P1001
P201-3 20
P201-1 20
P4080-7 9
P3890-5 8
P3890-8 8

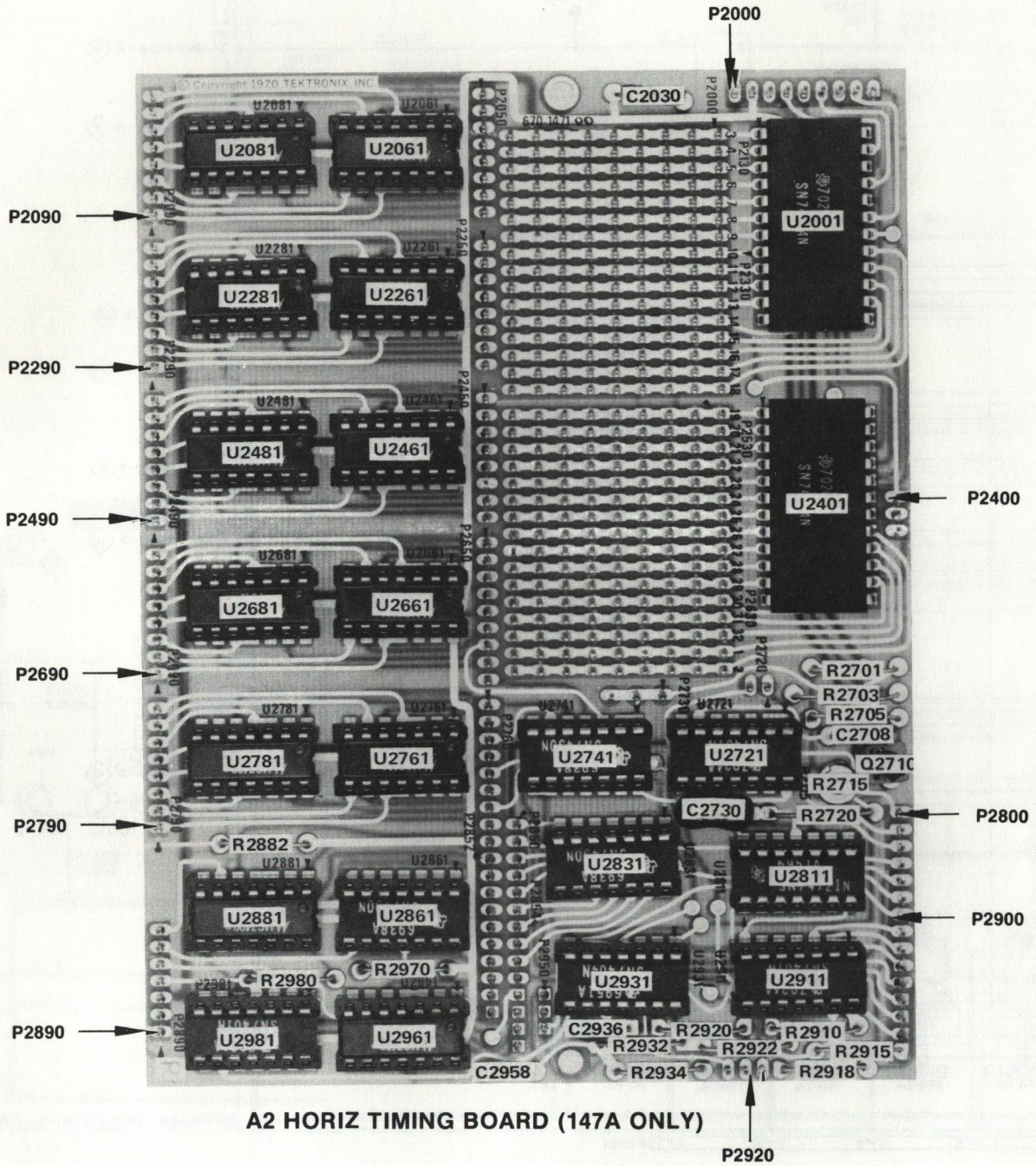
VERTICAL INTEGRATOR

2
TP1410
COMP SYNC FROM P1701-1 3
R1710 1k
C1701 1000
R1701 51k
CR1720
Q1701
Q1601
R1602 6.34k
-15V
+5V
R1610 4.42k
R1502 3.3k
C1601 .027
Q1501
C1501 0.22
R1501 2.7M
R1400 1.8M
-15V
C1460 1000
CR1510
Q1421
Q1411
TP1530
R1520 33k
C1515 470
R1630 3.9k
Q1631
R1530 4.7k
R1631 10k
R1632 3.9k
C1650 470
R1650 1k
4
TP1390
R1098 1k
TP1096
R1365 1k 3
R1655 2k
P1691
P4390-6 9
P2400-1 5
TIME 31
TIME 15
U1461B 7410
CLOCK

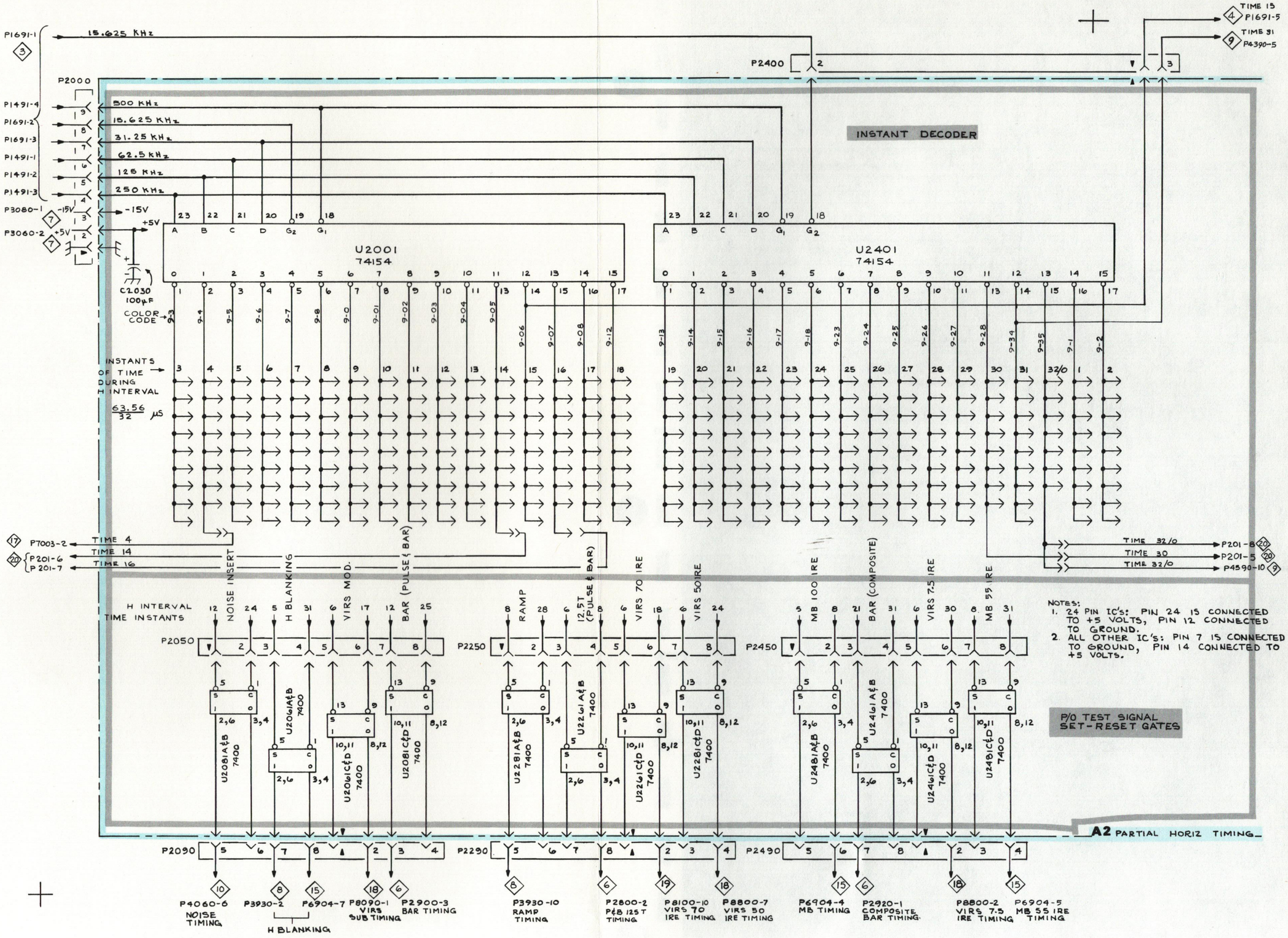
U1091A 7474
U1091B 7474
U1191A 7474
U1191B 7474
U1291A 7474
U1291B 7474
U1061A 7474
U1061B 7474
U1161 7474
U1161B 7474
÷525 COUNTER
P1061

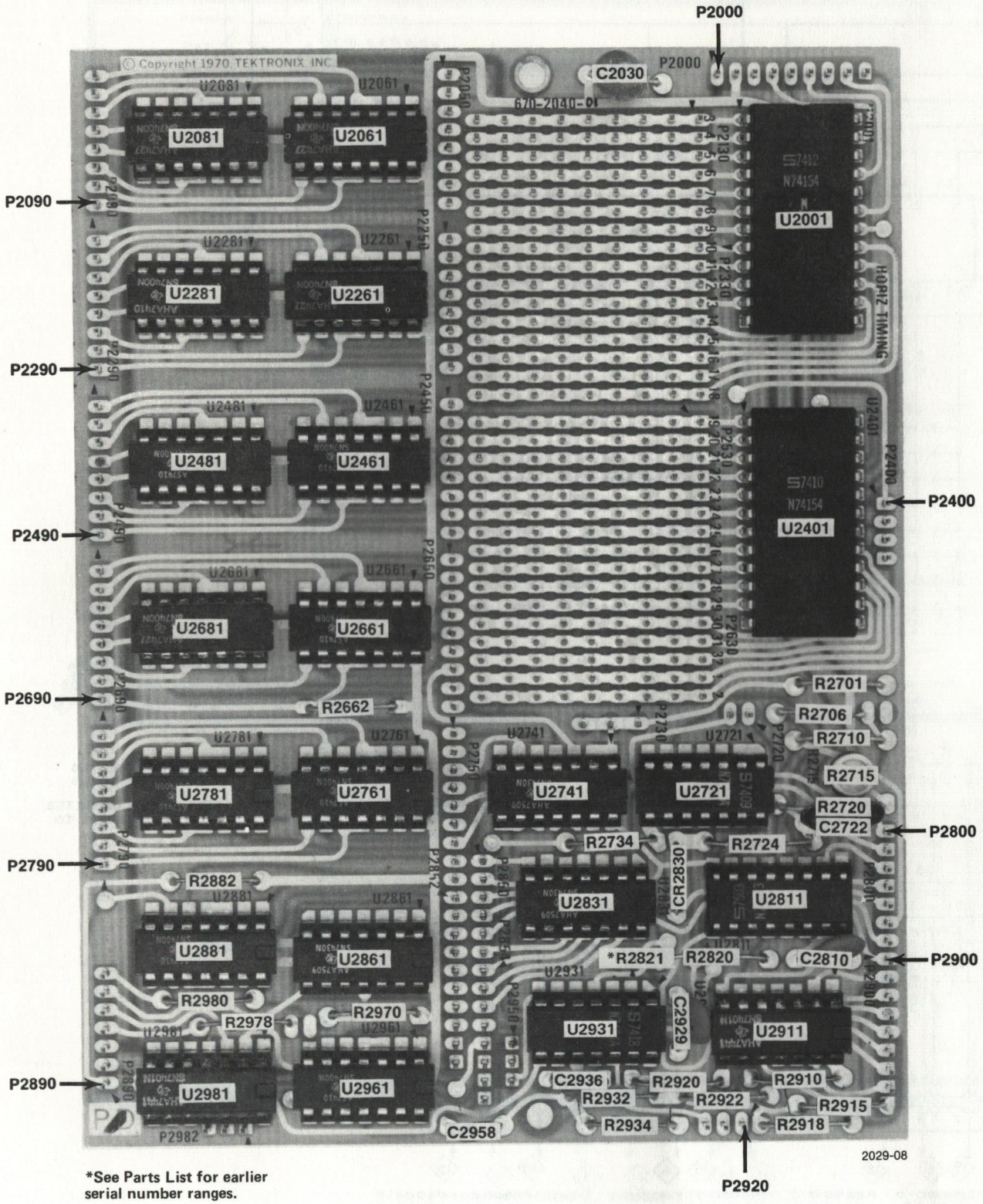
P/O HORIZ & VERT COUNTER BOARD

147A/149A @ VERTICAL COUNTER 4



A2 HORIZ TIMING BOARD (147A ONLY)


P1691-1
15.625 KHz
P2000
P1491-4
P1691-2
P1691-3
P1491-1
P1491-2
P1491-3
P3080-1
P3060-2
500 KHz
15.625 KHz
31.25 KHz
62.5 KHz
125 KHz
250 KHz
-15V
+5V
C2030
100µF
COLOR CODE
P2400
TIME 15
P1691-5
TIME 31
P4390-5
INSTANT DECODER
U2001
74154
U2401
74154
INSTANTS OF TIME DURING H INTERVAL
63.56/32 µS
P7003-2
TIME 4
TIME 14
TIME 16
P201-6
P201-7
TIME 32/0
TIME 30
TIME 32/0
P201-8
P201-5
P4590-10
H INTERVAL TIME INSTANTS
NOISE INSERT
H BLANKING
VIRS MOD.
BAR (PULSE & BAR)
RAMP
12.5T (PULSE & BAR)
VIRS 70 IRE
VIRS 50 IRE
MB 100 IRE
BAR (COMPOSITE)
VIRS 7.5 IRE
MB 55 IRE
P2050
P2250
P2450
P2090
P2290
P2490
U2081A&B 7400
U2061A&B 7400
U2061C&D 7400
U2081C&D 7400
U2281A&B 7400
U2261A&B 7400
U2261C&D 7400
U2281C&D 7400
U2481A&B 7400
U2461A&B 7400
U2461C&D 7400
U2481C&D 7400
P4060-6 NOISE TIMING
P3930-2
P6904-7
H BLANKING
P8090-1 VIRS SUB TIMING
P2900-3 BAR TIMING
P3930-10 RAMP TIMING
P2800-2 P&B 12.5T TIMING
P8100-10 VIRS 70 IRE TIMING
P8800-7 VIRS 50 IRE TIMING
P6904-4 MB TIMING
P2920-1 COMPOSITE BAR TIMING
P8800-2 VIRS 7.5 IRE TIMING
P6904-5 MB 55 IRE TIMING
NOTES:
1. 24 PIN IC's: PIN 24 IS CONNECTED TO +5 VOLTS, PIN 12 CONNECTED TO GROUND.
2. ALL OTHER IC's: PIN 7 IS CONNECTED TO GROUND, PIN 14 CONNECTED TO +5 VOLTS.
P/O TEST SIGNAL SET-RESET GATES
A2 PARTIAL HORIZ TIMING



*See Parts List for earlier serial number ranges.

A2 HORIZ TIMING BOARD (149A ONLY)

REV. B JAN 1977

P/O A2 HORIZ TIMING CIRCUIT BOARD

NOTES:
24 PIN IC'S: PIN 24 IS CONNECTED TO +5VOLTS, PIN 12 IS CONNECTED TO GROUND.
ALL OTHER IC'S: PIN 7 IS CONNECTED TO GROUND, PIN 14 IS CONNECTED TO +5 VOLTS.

P2400 P1691-1 — 15.734KHz

P2000 P1491-4 — 503.5KHz
P1691-2 — 15.734KHz
P1691-3 — 31.5 KHz
P1491-1 — 62.9 KHz
P1491-2 — 125.9KHz
P1491-3 — 251.75KHz

-15V — P2000 -15V P3080-1 (7)
+5V — P2000 +5V P3060-2 (7)
C2030 100MF

U2001 74154 — U2401 74154

COLOR CODE 9-3, 9-4, 9-5, 9-6, 9-7, 9-8, 9-0, 9-01, 9-02, 9-03, 9-04, 9-05, 9-06, 9-07, 9-08, 9-12, 9-13, 9-14, 9-15, 9-16, 9-17, 9-18, 9-23, 9-24, 9-25, 9-26, 9-27, 9-28, 9-34, 9-35, 32/0, 9-1, 9-2

INSTANTS OF TIME DURING H INTERVAL — $\frac{63.56}{32}\mu s$

INSTANT DECODER

P2400 (4): P1691-5 — TIME 15; P4390-5 (9) — TIME 32/0, TIME 31

P2130: TIME 4 P7003-2 (17); TIME 5 P3200-1 (7); TIME 8 P458-5 (19); TIME 9 P3200-2 (7); TIME 11 P420-1 (19); TIME 12 P498-2; TIME 12 P3200-3 (7); TIME 14 P201-6 (20); TIME 15 P3200-4 (7); TIME 16 P201-7 (20); TIME 16 P401-2 (19); TIME 18 P498-1; TIME 18 3200-5 (7)

P2330

P2530: TIME 21 P3200-6 (7); TIME 24 3200-7 (7); TIME 24 P401-3 (19)

P2630: TIME 27 3200-8 (7); TIME 30 P201-5 (20); TIME 3210 P201-8 (20); TIME 0 P4590-10 (9)

H INTERVAL TIME INSTANTS → 5 P401-1 (19)

CONNECTOR CODE → 4 P2050

P/O TEST SIGNAL SET-RESET GATES

	MOD PED 20 IRE	H BLANKING	VIRS SUB TIMING	BAR TIMING	RAMP TIMING	12.5T PULSE & MOD TIMING	VIRS 70 IRE	VIRS 50 IRE	MB 100 IRE	COMPOSITE BAR	VIRS 7.5 IRE	MB 55 IRE
	5	5, 31	6, 17	12, 25	8, 28	6, 8	6, 18	6, 24	5, 8	22, 31	6, 30	8, 31
P2050 / P2250 / P2450	2	3, 4	5, 6	7, 8	2	3, 4	5, 6	7, 8	2	3, 4	5, 6	7, 8
	U2081 A&B 7400	U2061 A&B 7400	U2061 C&D 7400	U2081 C&D 7400	U2281 A&B 7400	U2261 A&B 7400	U2261 C&D 7400	U2281 C&D 7400	U2481 A&B 7400	U2461 A&B 7400	U2461 C&D 7400	U2481 C&D 7400

P2090: P498-6 (19); P3930-2 (8); P6904-7 (15); P8600-2 (18); P2900-4 (6)

P2290: P3930-10 (8); P2800-2 (6); P401-5 (19); P458-4 (19)

P2490: P6904-4 (15); P2920-1 (6); P458-2 (19); P6904-5 (15)

HORIZONTAL TIMING (5)
(MATRIX & FLIP-FLOPS)

A2 PARTIAL HORIZ TIMING

10 STEP TIMING

STAIRCASE LOGIC

BURST WIDTH

MODULATED PULSE TIMING

BAR TIMING

PULSE TIMING

½ INSTANT TIMING

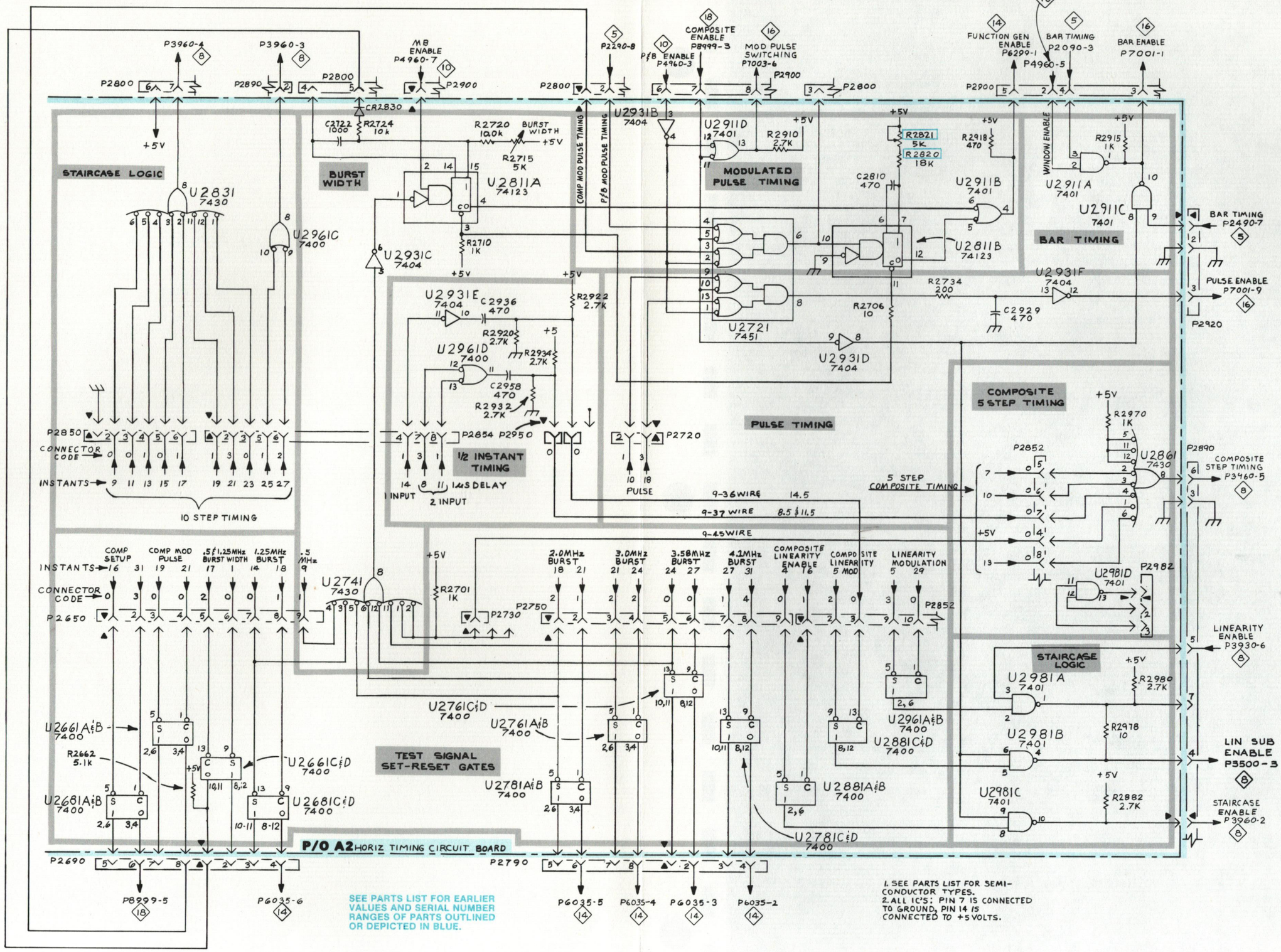
TEST SIGNAL SET-RESET GATES

STAIRCASE LOGIC

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. ALL IC'S: PIN 7 IS CONNECTED TO GROUND, PIN 14 CONNECTED TO +5 VOLTS.

147A

HORIZONTAL TIMING (SIGNAL TIMING LOGIC) 6

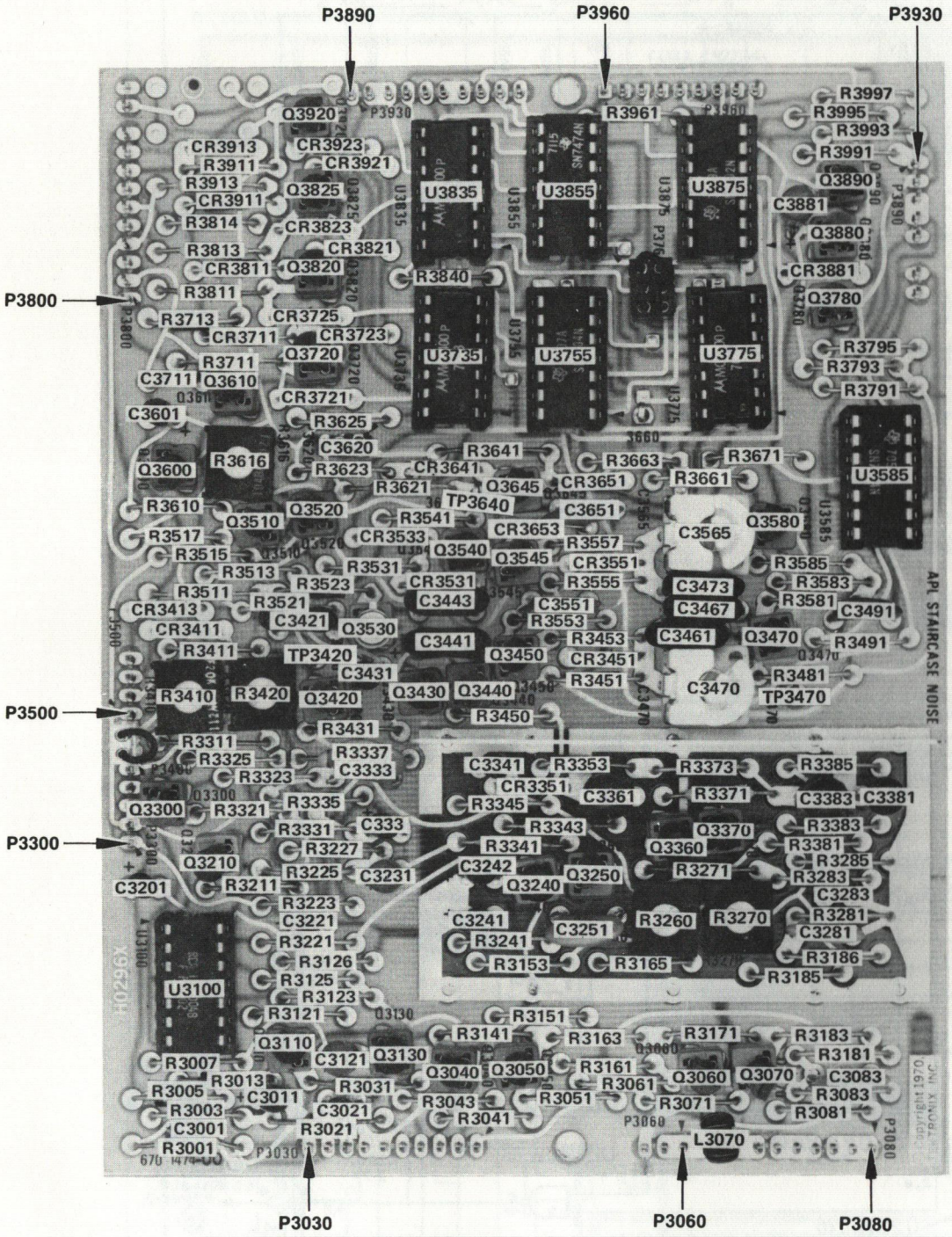


SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.

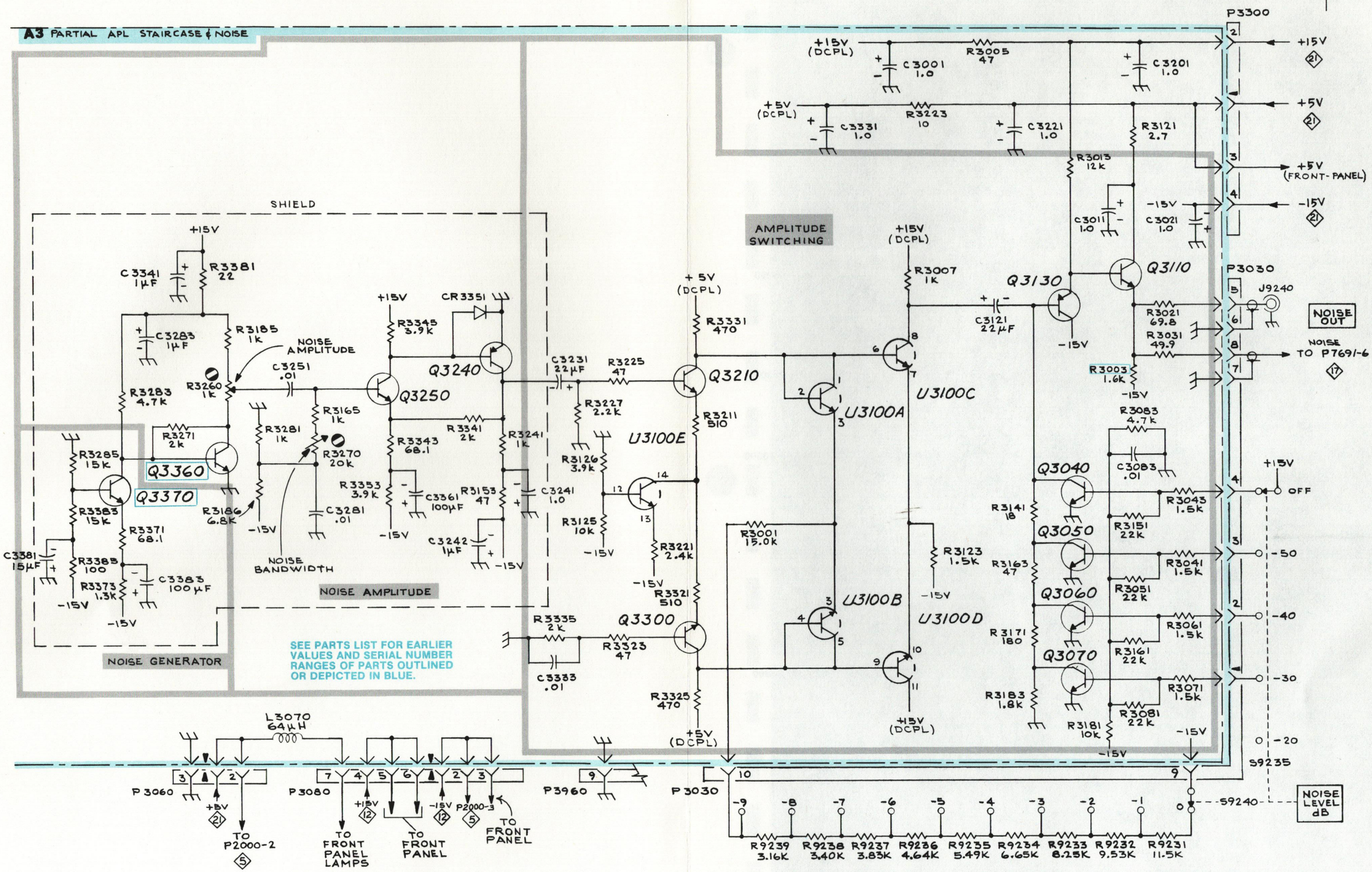
1. SEE PARTS LIST FOR SEMI-CONDUCTOR TYPES.
2. ALL IC'S: PIN 7 IS CONNECTED TO GROUND, PIN 14 IS CONNECTED TO +5 VOLTS.

(1646) 2029-143
REV. A, JAN. 1977

HORIZONTAL TIMING (SIGNAL TIMING LOGIC) 6

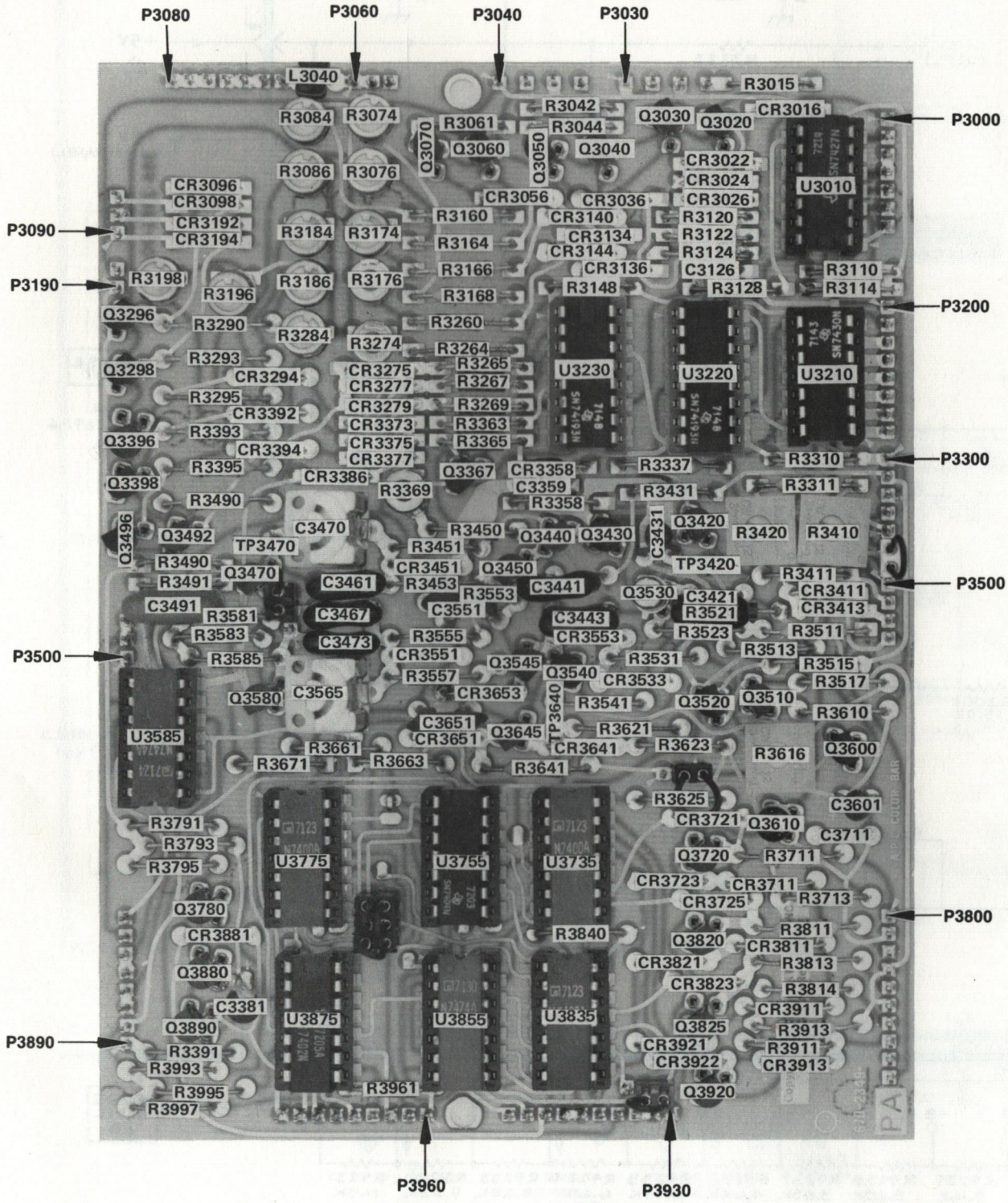


A3 APL STAIRCASE & COLOR BAR BOARD (147A ONLY)



NOTE:
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

NOISE GENERATOR (7)



A3 APL STAIRCASE AND COLOR BAR BOARD (149A)

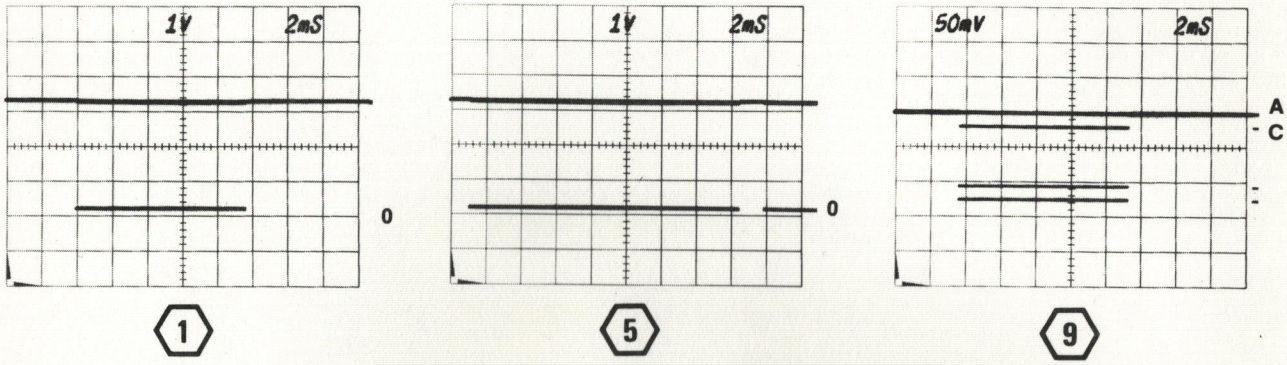
A3 APL STAIRCASE & COLOR BAR BOARD (149A ONLY)

@

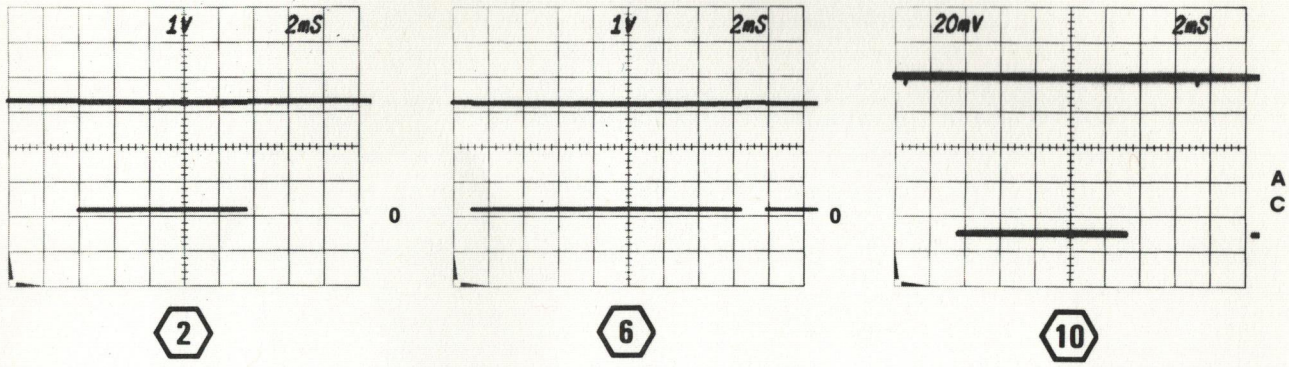
7

WAVEFORMS

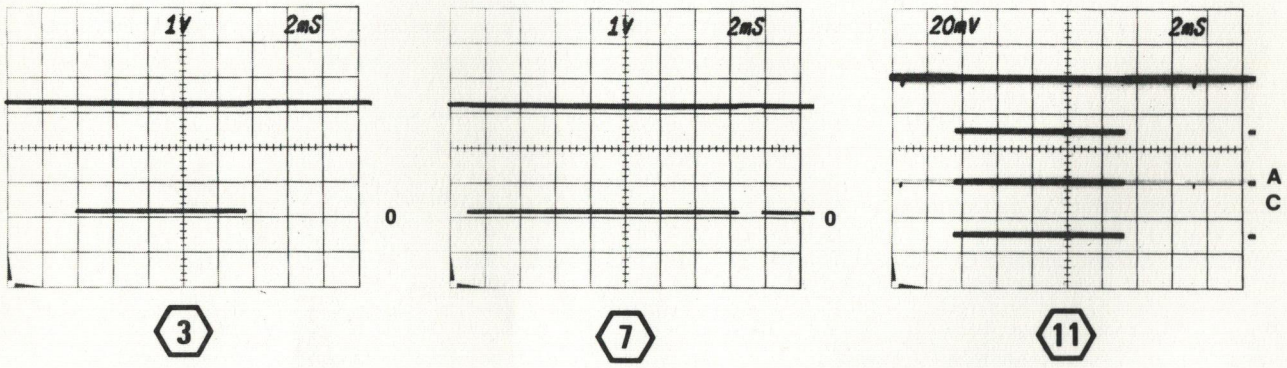
(149A ONLY)



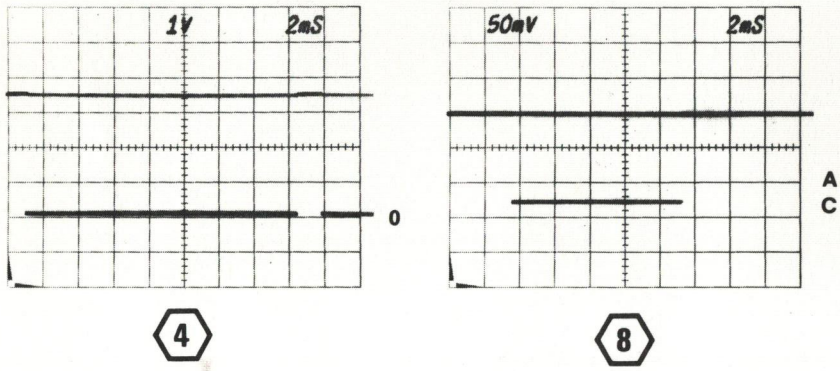
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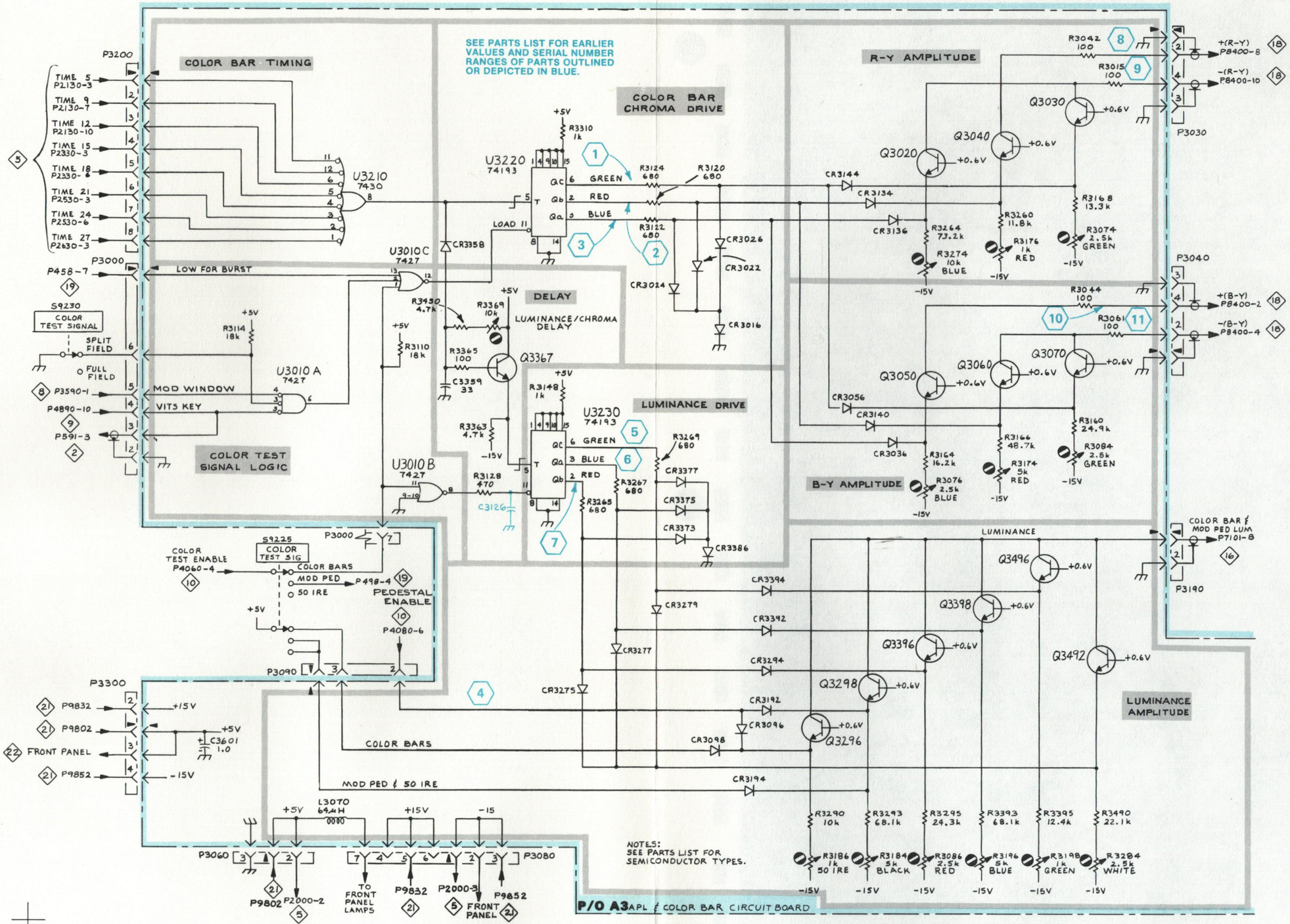
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9

10

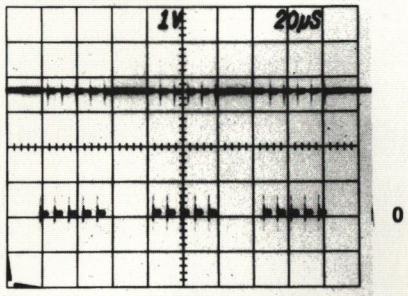
11

Waveforms and Voltages obtained under conditions given on the Diagram Title page except: All waveforms and FF signal switch to color test signal.

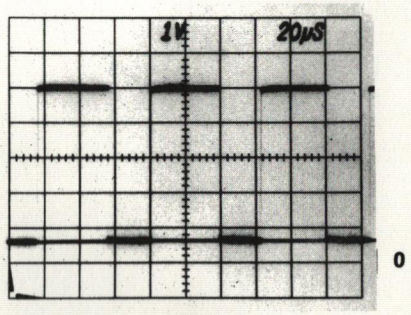


(1646) 2029-145
REV A JUL 1979

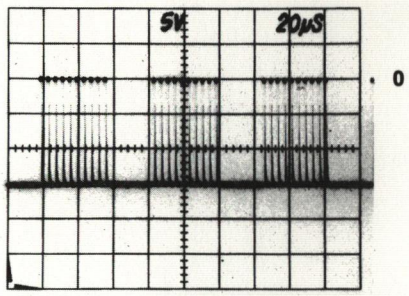
8
WAVEFORMS
(147A ONLY)



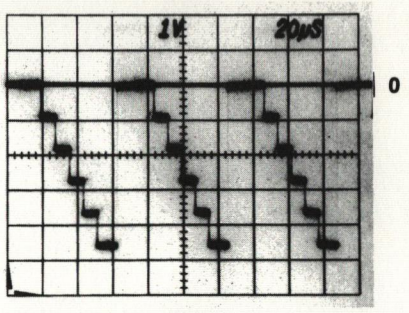
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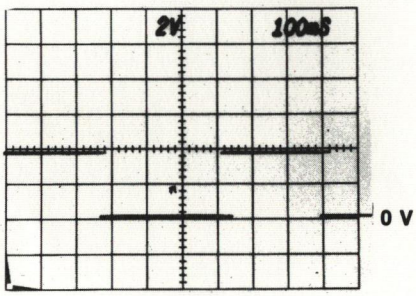
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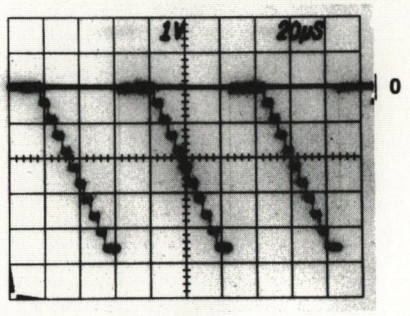
2



5

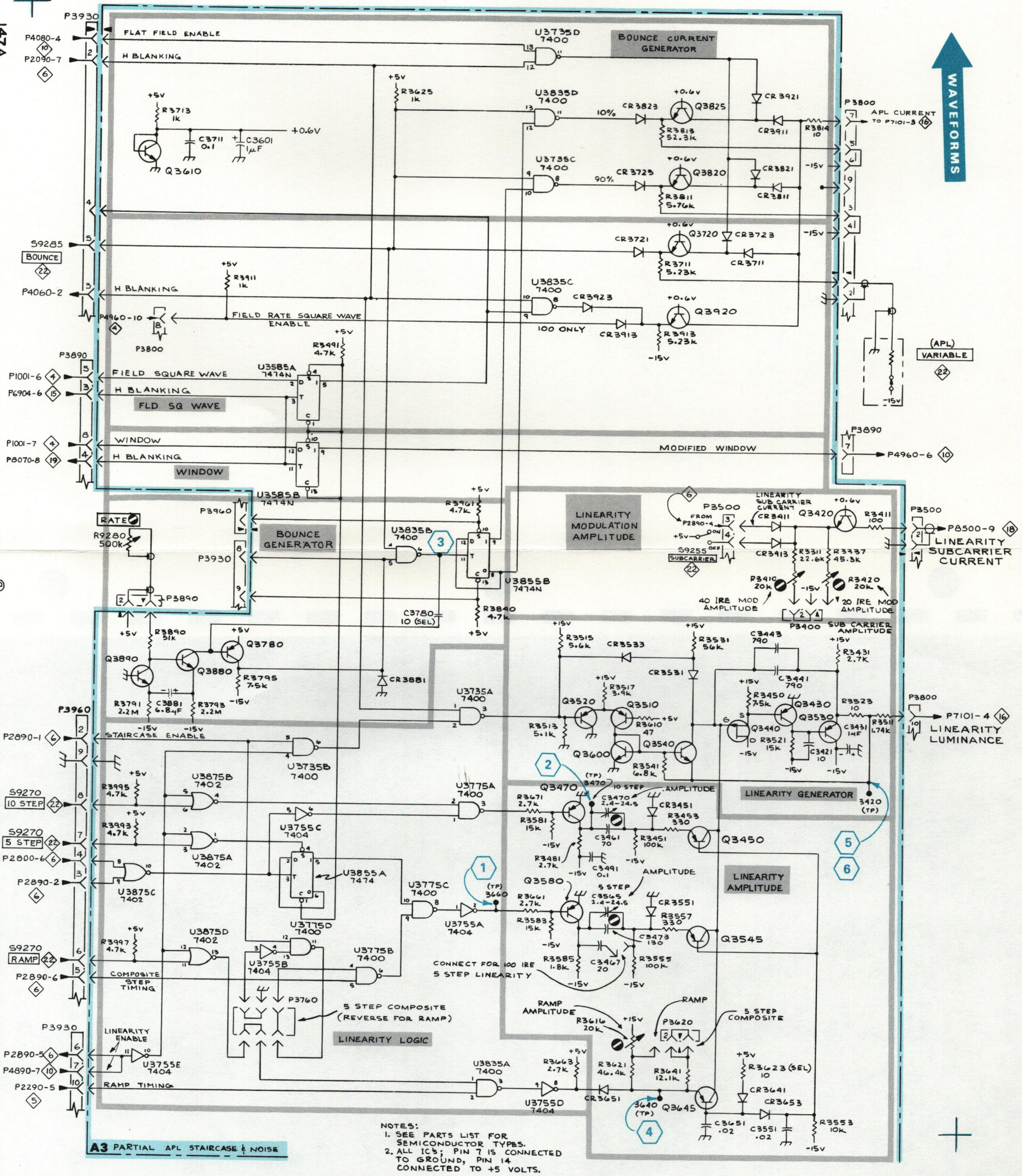


3



6

Waveforms and Voltages are obtained under conditions given on the Diagram Title page except: All waveforms, DTM set to view any active line within field and the FULL FIELD SIG MODE switch set to LINEARITY; waveform (5) LINEARITY MODE SWITCH set to 5 step, (6) LINEARITY MODE SWITCH set to 10 step.



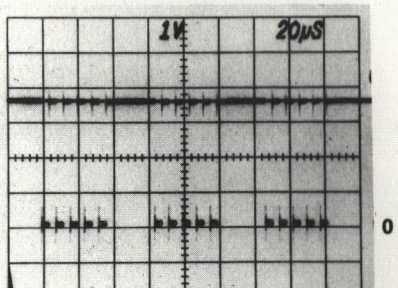
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. ALL ICS; PIN 7 IS CONNECTED TO GROUND, PIN 14 CONNECTED TO +5 VOLTS.

A3 PARTIAL APL STAIRCASE & NOISE

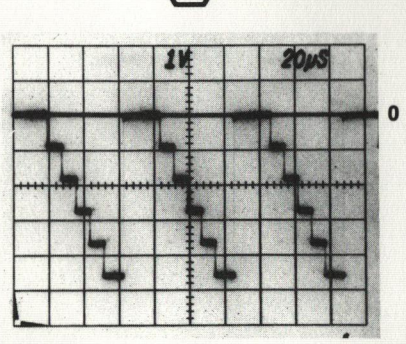
STAIRCASE & APL ⑧

8
WAVEFORMS

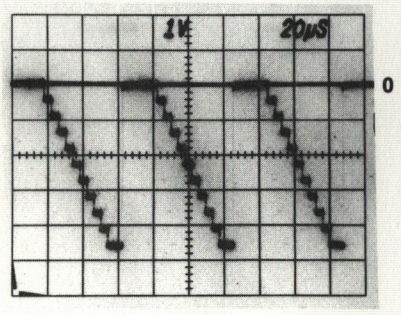
(149A ONLY)



1

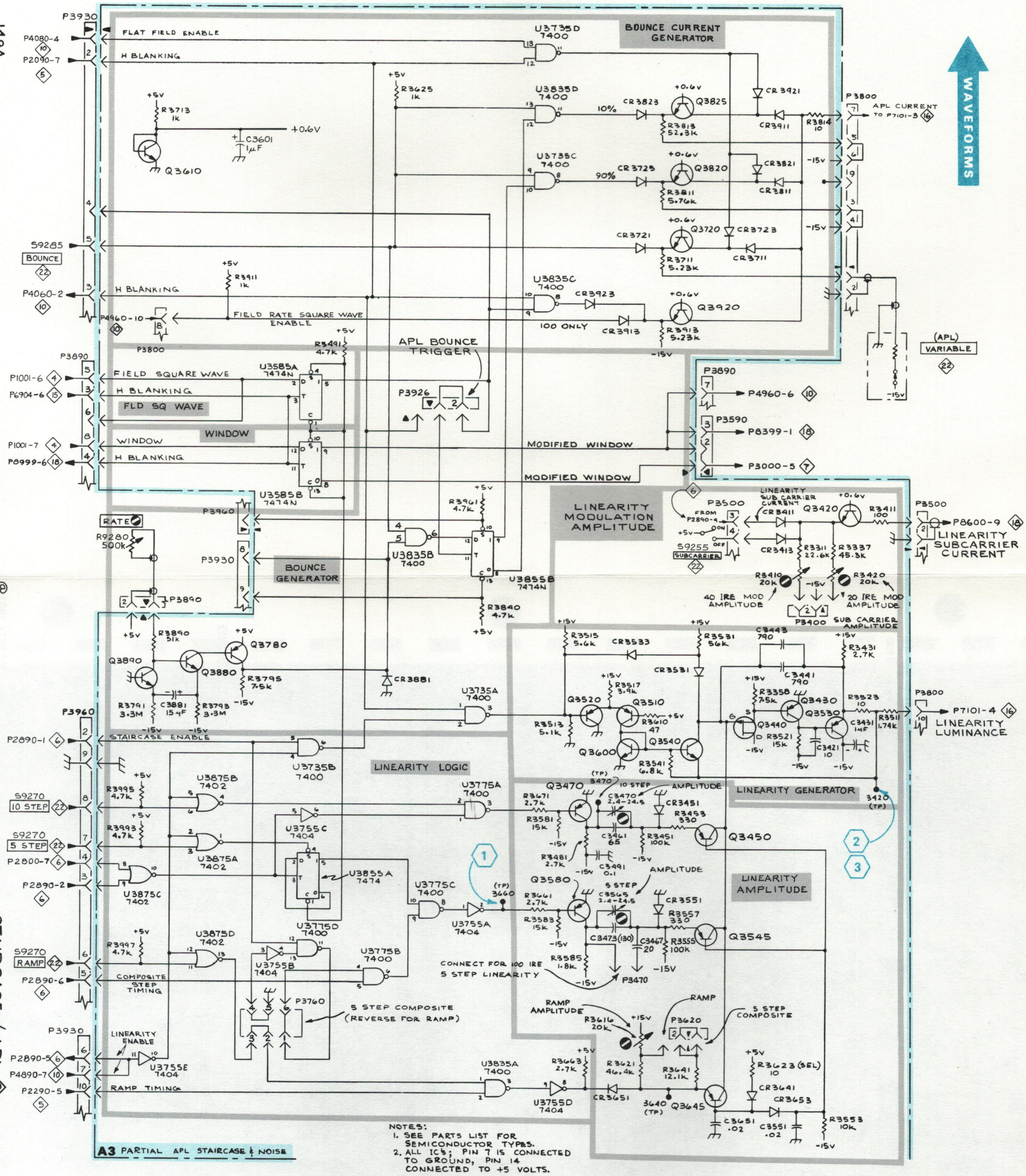


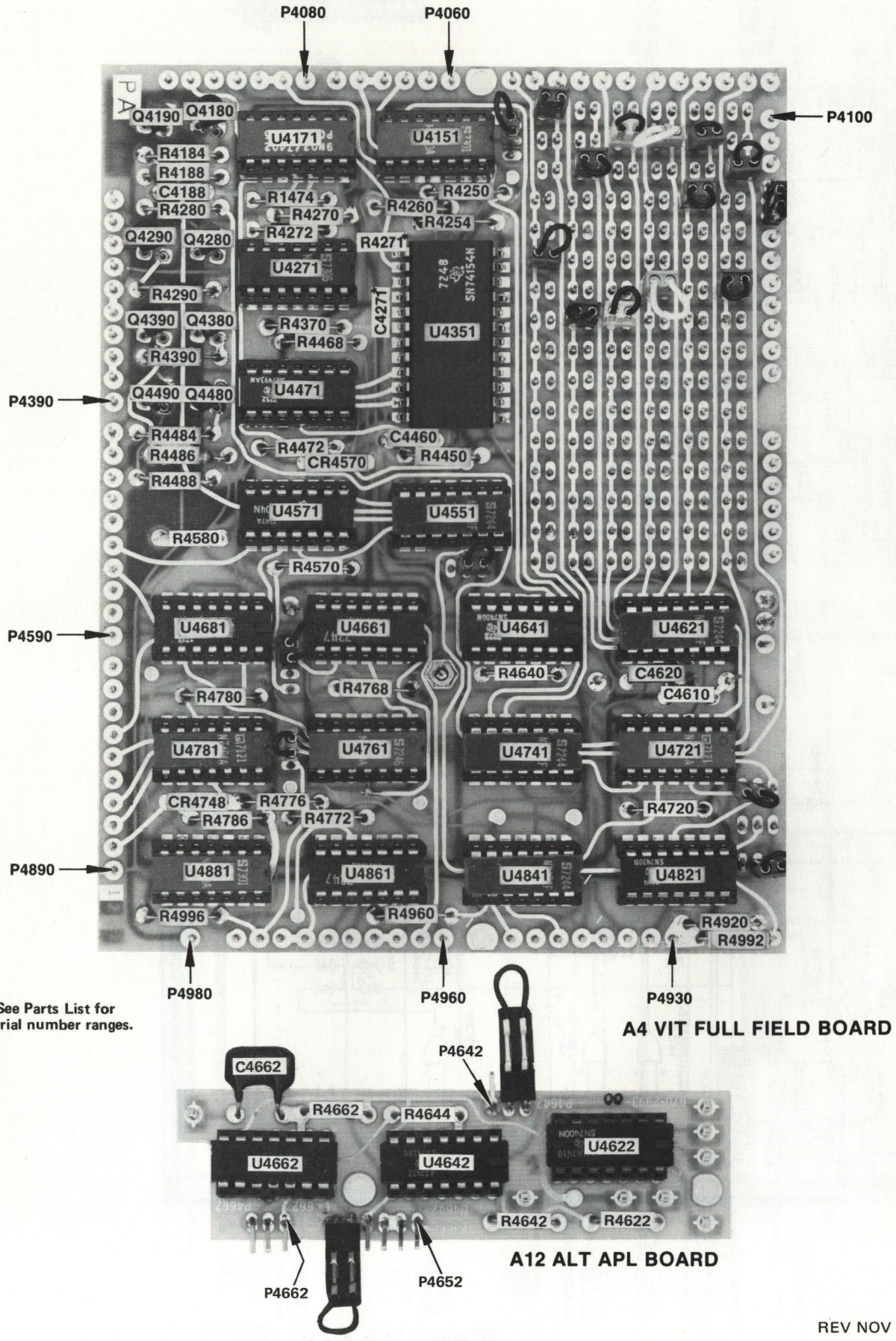
2



3

Waveforms and Voltages obtained under conditions given on the Diagram Title page except: All waveforms, DTM set to view any active line within the field and the FULL FIELD SIG Mode switch set to LINEARITY; waveform 2 , LINEARITY Mode switch set to 5 STEP; waveform 3 , LINEARITY Mode switch set to 10 STEP.

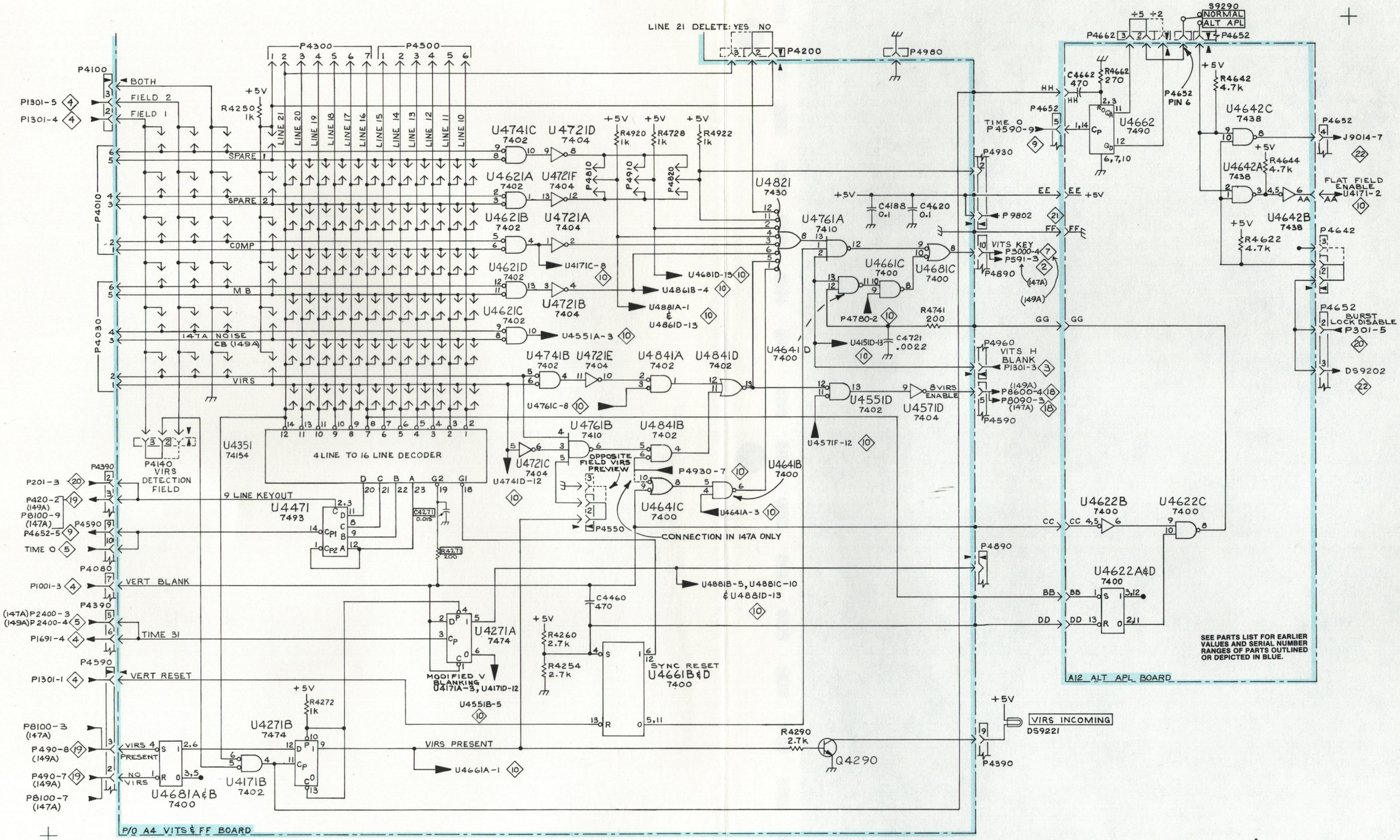

WAVEFORMS
BOUNCE CURRENT GENERATOR
APL BOUNCE TRIGGER
BOUNCE GENERATOR
LINEARITY MODULATION AMPLITUDE
LINEARITY LOGIC
LINEARITY GENERATOR
LINEARITY AMPLITUDE
FLAT FIELD ENABLE
H BLANKING
FIELD RATE SQUARE WAVE ENABLE
FIELD SQUARE WAVE
FLD SQ WAVE
WINDOW
MODIFIED WINDOW
STAIRCASE ENABLE
LINEARITY ENABLE
RAMP TIMING
COMPOSITE STEP TIMING
5 STEP COMPOSITE (REVERSE FOR RAMP)
CONNECT FOR 100 IRE 5 STEP LINEARITY
APL CURRENT TO P7101-3
LINEARITY SUBCARRIER CURRENT
LINEARITY LUMINANCE
SUB CARRIER AMPLITUDE
40 IRE MOD AMPLITUDE
20 IRE MOD AMPLITUDE
BOUNCE
10 STEP
5 STEP
RAMP
SUBCARRIER
(APL) VARIABLE
RATE
STAIRCASE & APL
A3 PARTIAL APL STAIRCASE & NOISE
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. ALL ICs; PIN 7 IS CONNECTED TO GROUND, PIN 14 CONNECTED TO +5 VOLTS.



*See Parts List for serial number ranges.

A4 VIT FULL FIELD BOARD

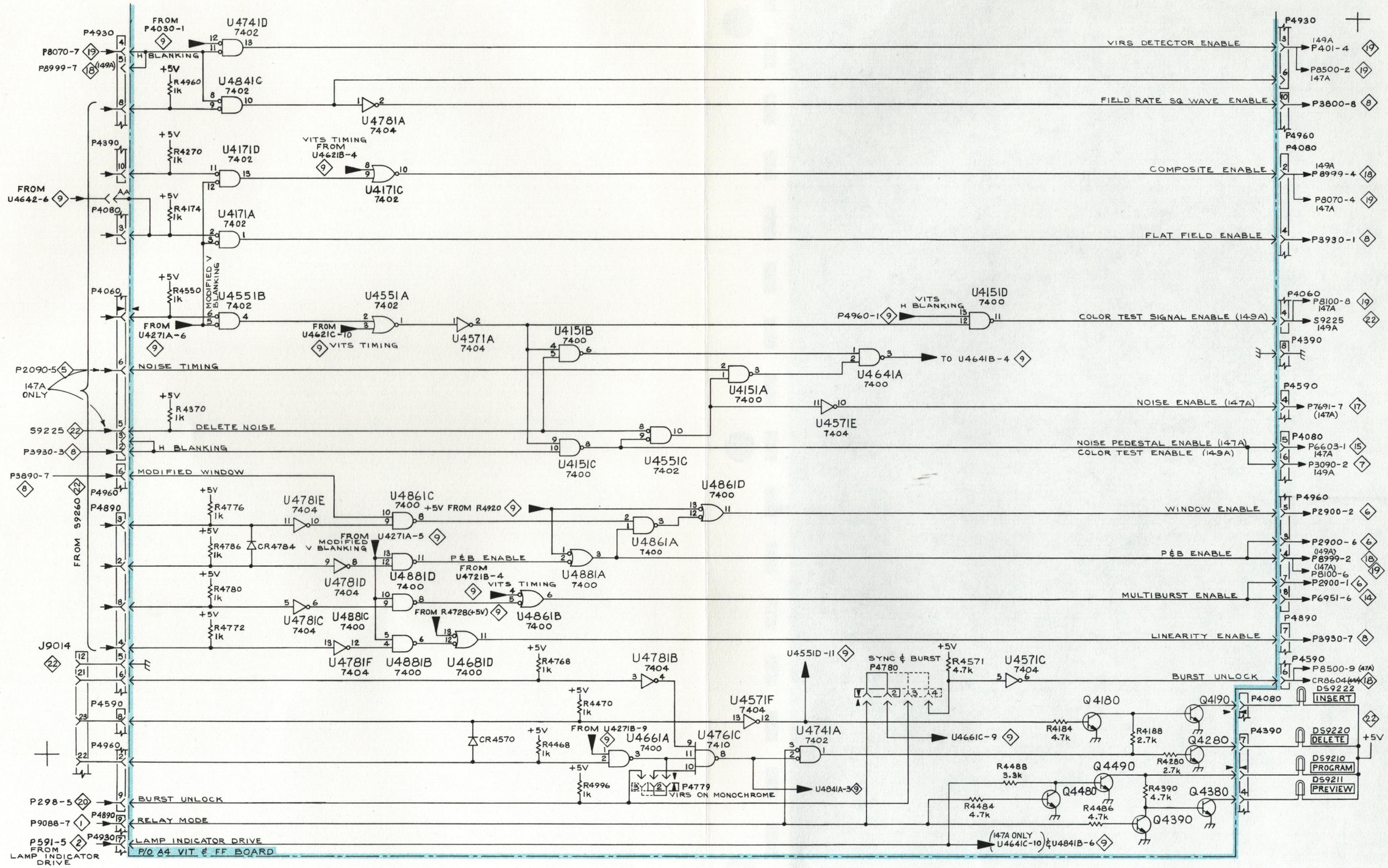
A12 ALT APL BOARD

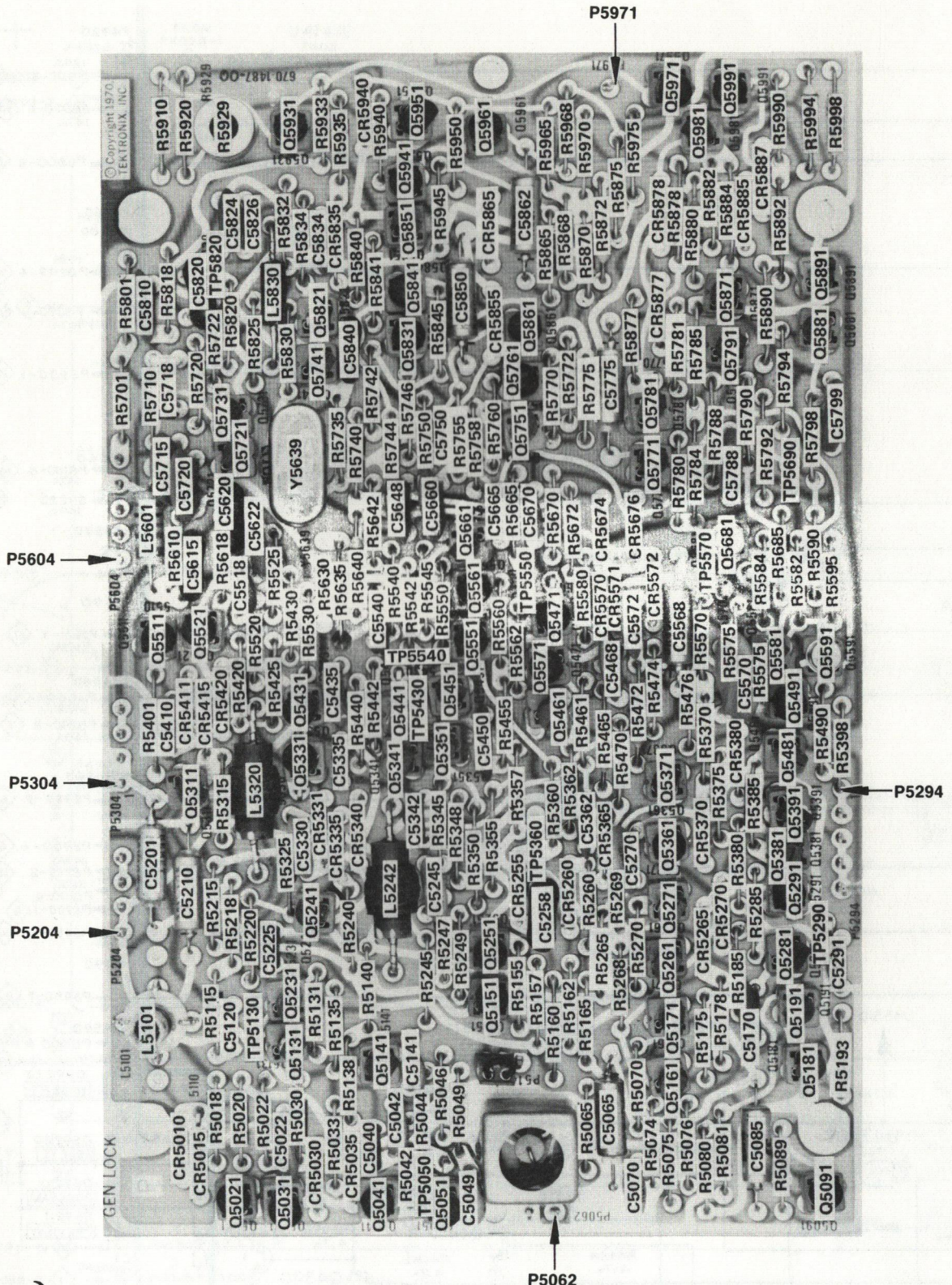


147A/149A

2029-148
REV NOV 1981

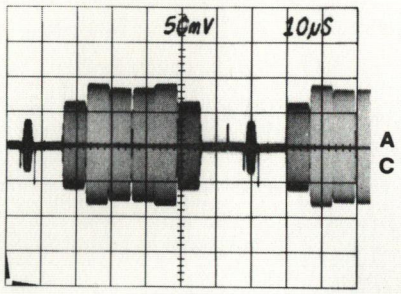
VITS LOGIC 9


P4930
P8070-7
P8999-7
FROM P4030-1
H BLANKING
+5V
R4960 1k
U4741D 7402
U4841C 7402
U4781A 7404
VIRS DETECTOR ENABLE
FIELD RATE SQ WAVE ENABLE
P4960
P4080
149A P401-4
P8500-2 147A
P3800-8
P4390
R4270 1k
U4171D 7402
VITS TIMING FROM U4621B-4
U4171C 7402
COMPOSITE ENABLE
149A P8999-4
P8070-4 147A
FROM U4642-6
R4174 1k
U4171A 7402
FLAT FIELD ENABLE
P3930-1
P4060
R4550 1k
U4551B 7402
MODIFIED V BLANKING
U4551A 7402
FROM U4271A-6
FROM U4621C-10
VITS TIMING
U4571A 7404
U4151B 7400
U4151D 7400
VITS H BLANKING
P4960-1
COLOR TEST SIGNAL ENABLE (149A)
P8100-8 147A
S9225 149A
P2090-5
NOISE TIMING
147A ONLY
U4641A 7400
TO U4641B-4
U4151A 7400
P4590
R4370 1k
DELETE NOISE
S9225
P3930-3
H BLANKING
U4571E 7404
NOISE ENABLE (147A)
P7691-7 (147A)
U4151C 7400
U4551C 7402
NOISE PEDESTAL ENABLE (147A)
COLOR TEST ENABLE (149A)
P6603-1 147A
P3090-2 149A
P3890-7
MODIFIED WINDOW
FROM 59260
U4861D 7400
P4890
R4776 1k
U4781E 7404
U4861C 7400
+5V FROM R4920
WINDOW ENABLE
P2900-2
R4786 1k
CR4784
FROM U4271A-5
MODIFIED V BLANKING
U4781D 7404
U4881D 7400
P&B ENABLE
FROM U4721B-4
U4861A 7400
U4881A 7400
P2900-6 (149A)
P8999-2 (147A)
P8100-6
R4780 1k
VITS TIMING
MULTIBURST ENABLE
P2900-1
P6951-6
R4772 1k
U4781C 7404
U4881C 7400
FROM R4728(+5V)
U4861B 7400
LINEARITY ENABLE
P3930-7
J9014
U4781F 7404
U4881B 7400
U4681D 7400
R4768 1k
U4781B 7404
U4551D-11
SYNC & BURST P4780
R4571 4.7k
U4571C 7404
BURST UNLOCK
P8500-9 (47A)
CR8604 (47A)
DS9222 INSERT
R4470 1k
U4571F 7404
Q4180
Q4190
P4080
R4184 4.7k
R4188 2.7k
Q4280
P4390
DS9220 DELETE
+5V
CR4570
R4468 1k
FROM U4271B-9
U4661A 7400
U4761C 7410
U4741A 7402
U4661C-9
R4280 2.7k
Q4490
DS9210 PROGRAM
R4488 3.3k
Q4480
R4390 4.7k
Q4380
DS9211 PREVIEW
R4484 4.7k
R4486 4.7k
Q4390
R4996 1k
P4779 VIRS ON MONOCHROME
U4841A-3
P298-5
BURST UNLOCK
P9088-7
RELAY MODE
P591-5 FROM LAMP INDICATOR DRIVE
LAMP INDICATOR DRIVE
(147A ONLY) U4641C-10 & U4841B-6
P/O A4 VIT & FF BOARD

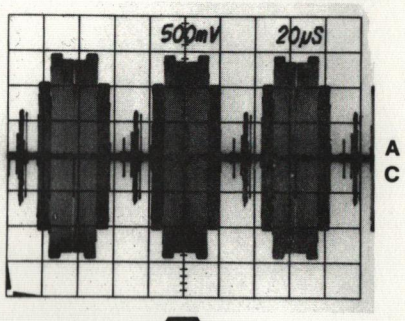


A5 GEN LOCK BOARD

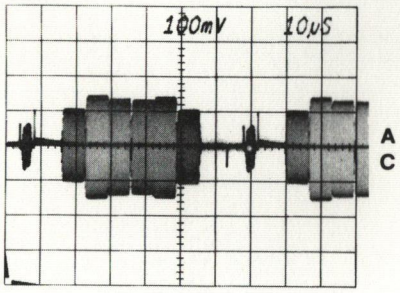
11 WAVEFORMS



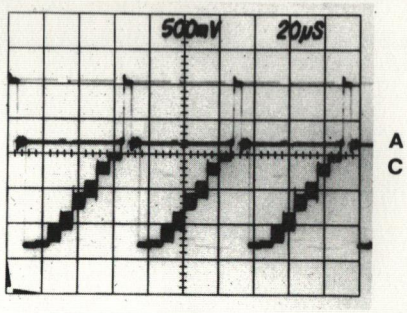
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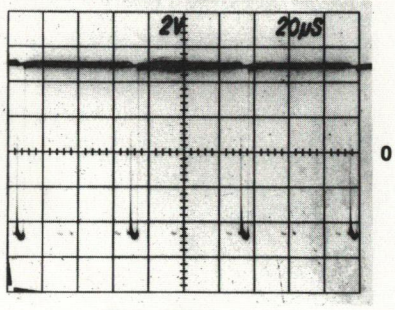
3



2

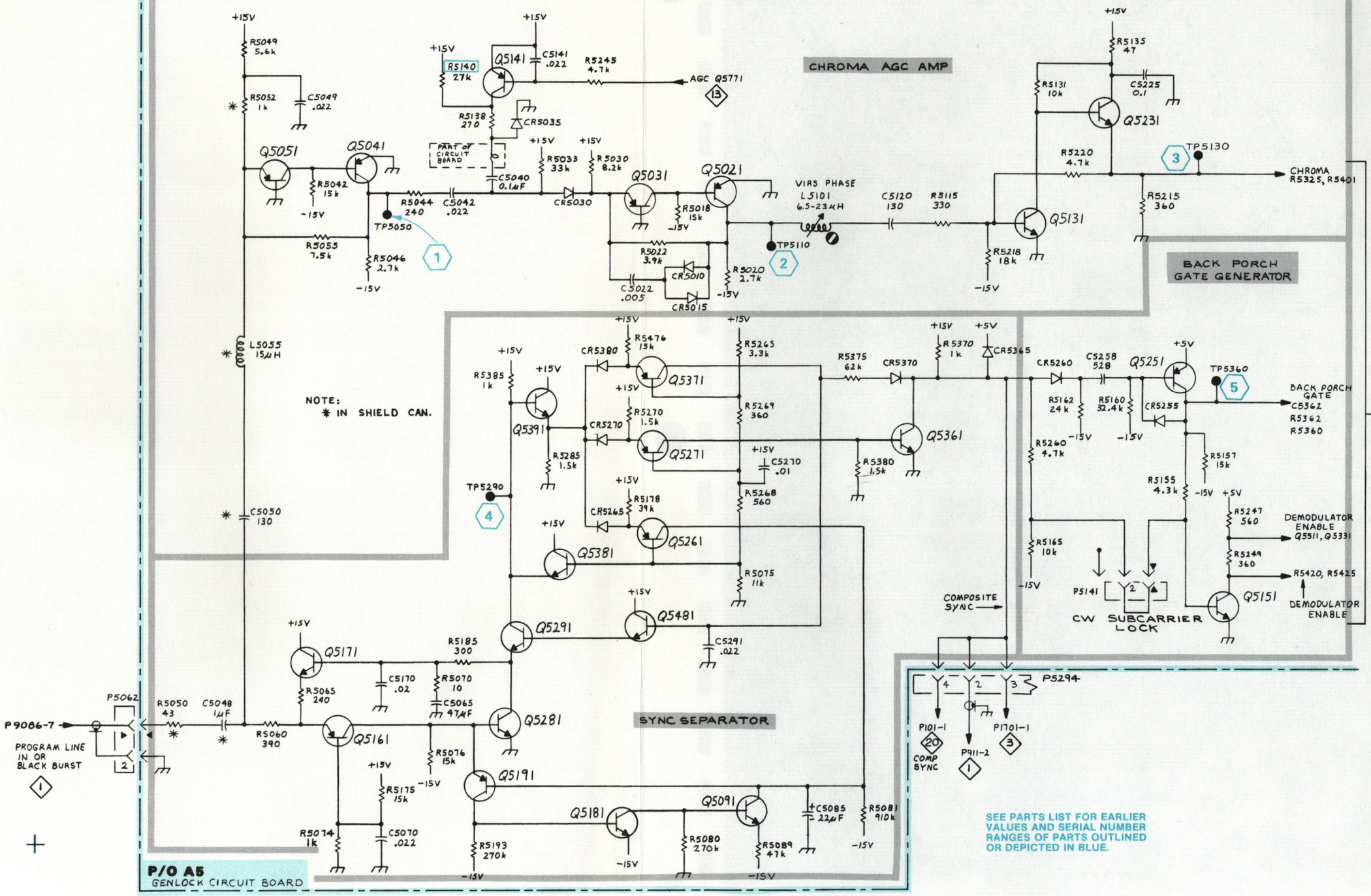


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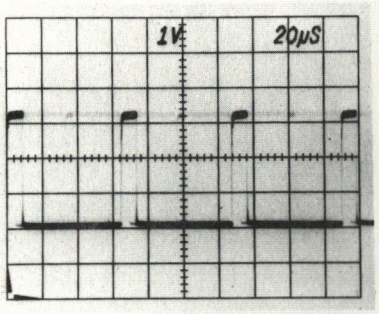
5

Waveforms and Voltages obtained under conditions given on the Diagram Title page.

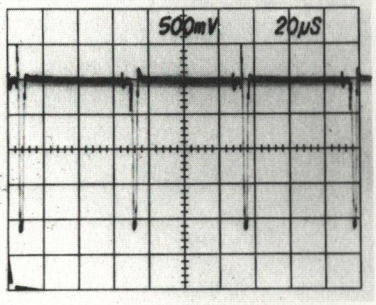


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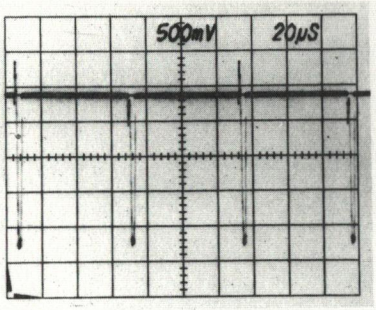
12
WAVEFORMS



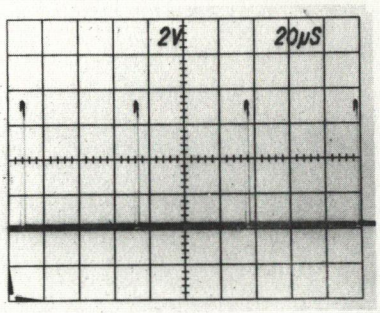
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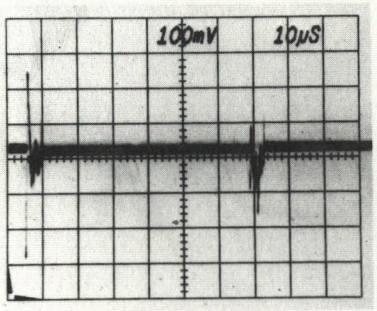
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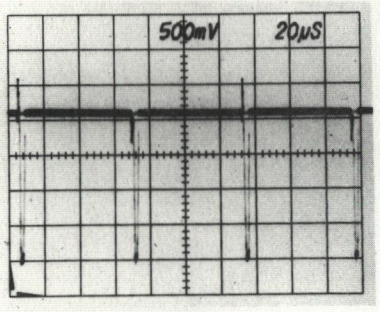
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4

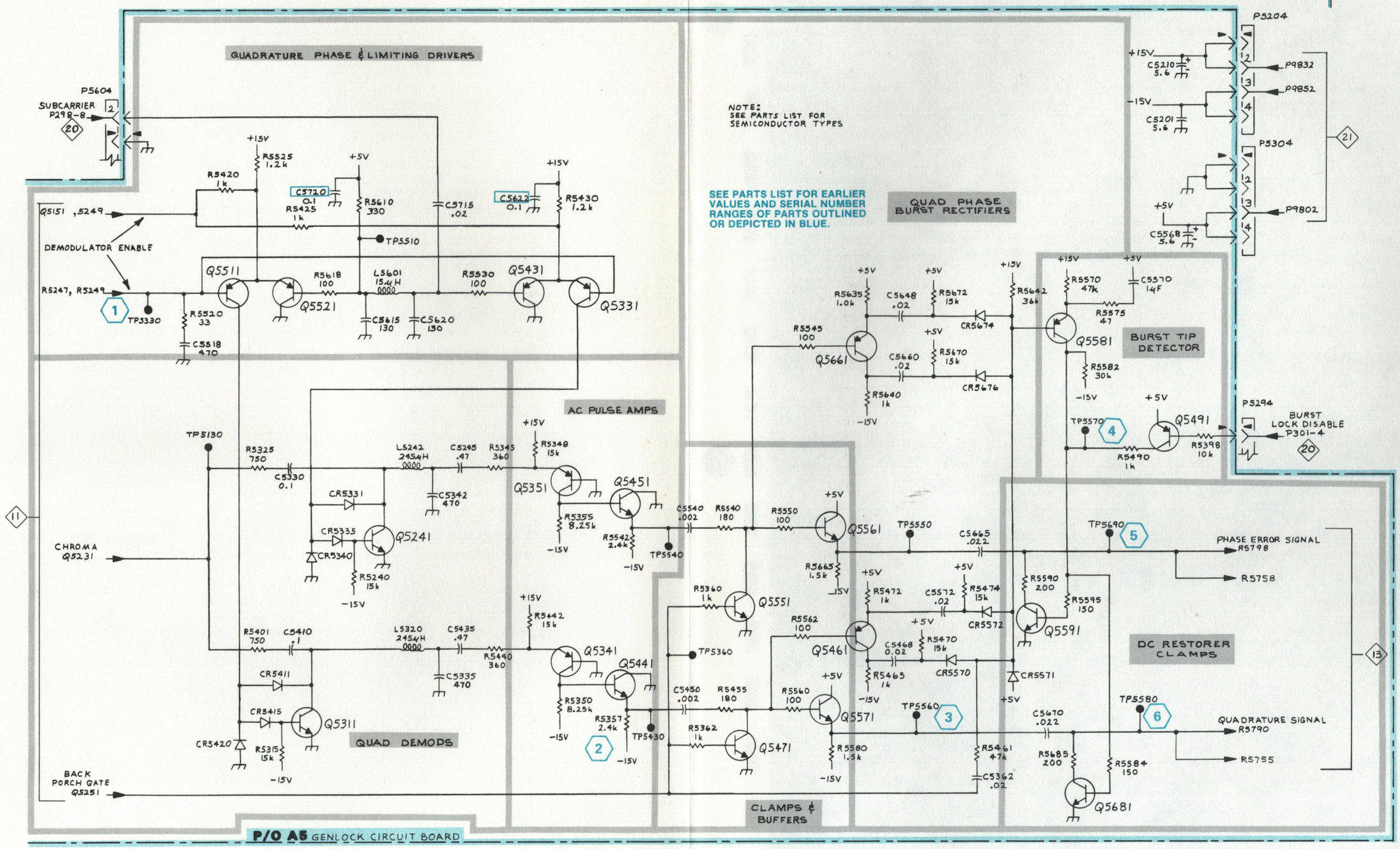


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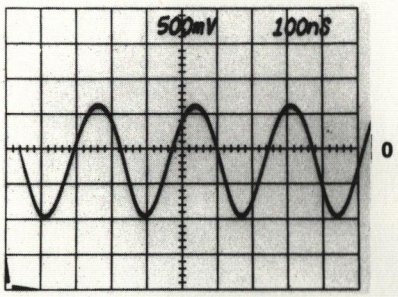


6

Waveforms and Voltages obtained under conditions given on the Diagram Title page.


QUADRATURE PHASE & LIMITING DRIVERS
P5604
SUBCARRIER P298-8
20
+15V
R5525 1.2k
R5420 1k
+5V
C5720 0.1
R5425 1k
R5610 330
C5715 .02
C5622 0.1
+15V
R5430 1.2k
Q5151 ,5249
DEMODULATOR ENABLE
TP5510
R5247, R5249
1
TP3330
Q5511
R5618 100
L5601 15μH
Q5521
R5530 100
Q5431
Q5331
R5520 33
C5518 470
C5615 130
C5620 130
AC PULSE AMPS
TP5130
R5325 750
C5330 0.1
L5242 2454H
C5245 .47
R5345 360
+15V
R5348 15k
Q5351
Q5451
CR5331
C5342 470
CR5335
CR5340
Q5241
R5240 15k
R5355 8.25k
R5542 2.4k
TP5540
C5540 .002
R5540 180
R5550 100
+5V
Q5561
TP5550
C5665 .022
R5665 1.5k
11
CHROMA Q5231
R5401 750
C5410 .1
L5320 2454H
C5435 .47
R5442 15k
R5440 360
Q5341
Q5441
TP5360
R5360 1k
Q5551
R5562 100
Q5461
C5468 0.02
R5465 1k
R5470 15k
CR5570
CR5571
CR5572
R5472 1k
C5572 .02
R5474 15k
R5590 200
R5595 150
Q5591
DC RESTORER CLAMPS
CR5411
CR5415
Q5311
CR5420
R5315 15k
QUAD DEMODS
TP5430
2
R5357 2.4k
R5350 8.25k
C5450 .002
R5455 180
R5560 100
Q5571
TP5560
3
R5362 1k
Q5471
R5580 1.5k
R5461 47k
C5362 .02
C5470 .022
TP5580
6
QUADRATURE SIGNAL R5790
R5755
R5685 200
R5584 150
Q5681
TP5690
5
PHASE ERROR SIGNAL R5798
R5758
BACK PORCH GATE Q5251
CLAMPS & BUFFERS
13
P/O A5 GENLOCK CIRCUIT BOARD
NOTE: SEE PARTS LIST FOR SEMICONDUCTOR TYPES
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.
QUAD PHASE BURST RECTIFIERS
R5635 1.0k
C5648 .02
R5672 15k
CR5674
R5642 36k
R5545 100
Q5661
C5660 .02
R5670 15k
CR5676
R5640 1k
-15V
R5570 47k
C5570 14F
R5575 47
Q5581
BURST TIP DETECTOR
R5582 30k
TP5570
4
R5490 1k
Q5491
R5398 10k
P5294
BURST LOCK DISABLE P301-4
20
P5204
+15V
C5210 5.6
P9832
-15V
C5201 5.6
P9852
P5304
+5V
C5568 5.6
P9802
21

13
WAVEFORMS



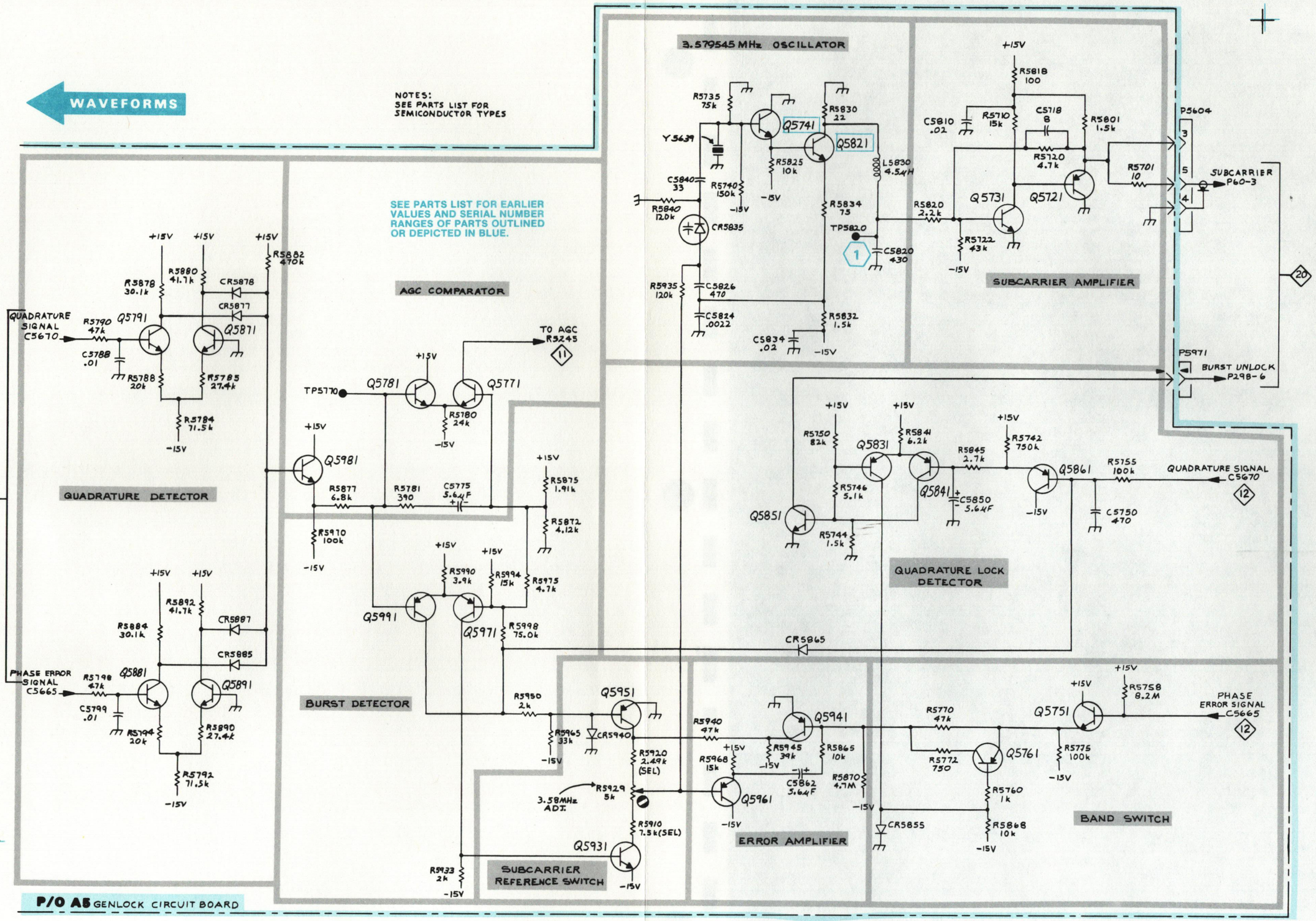
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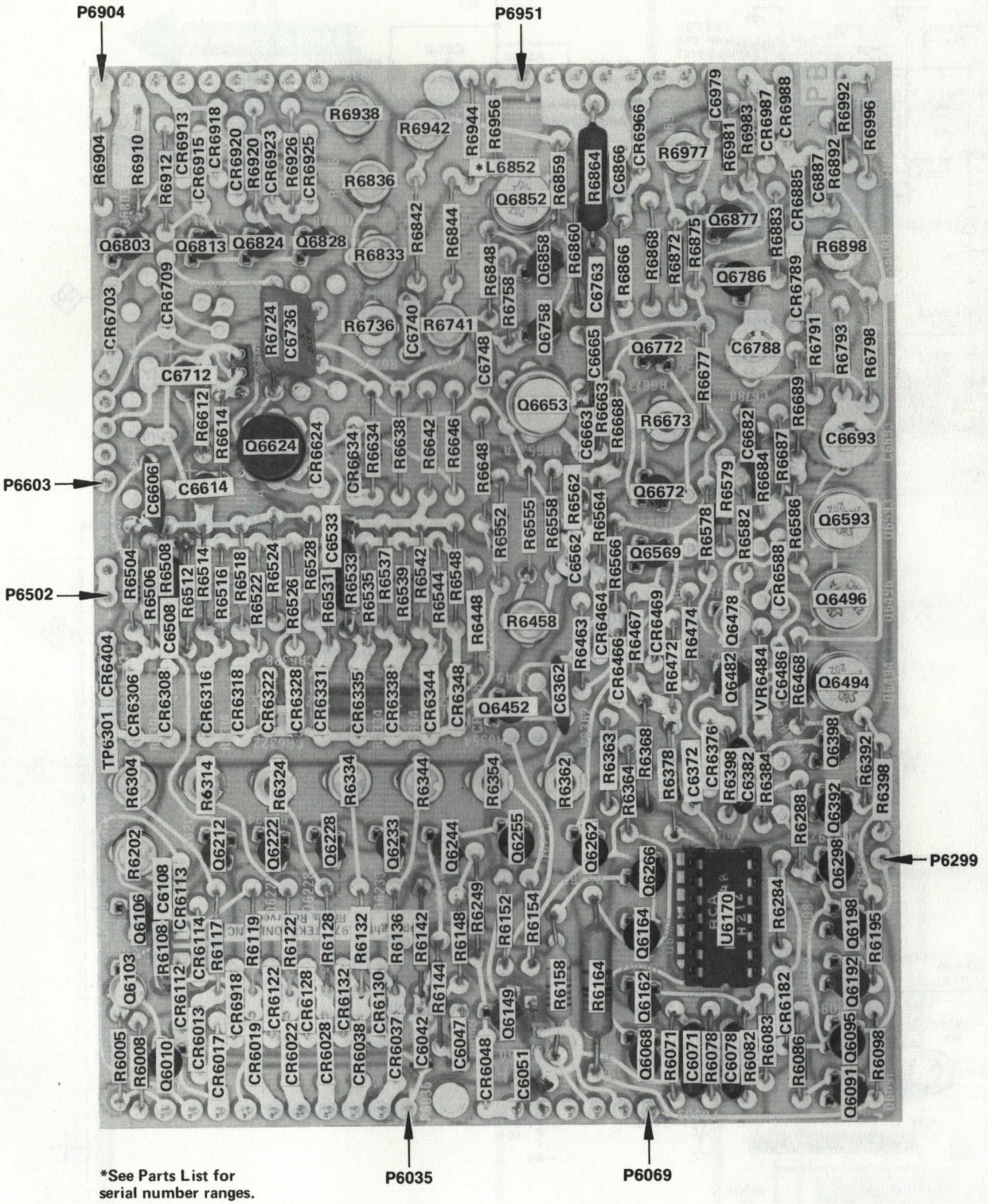
Waveforms and Voltages obtained under conditions given on the Diagram Title page.

WAVEFORMS

NOTES:
SEE PARTS LIST FOR SEMICONDUCTOR TYPES

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.

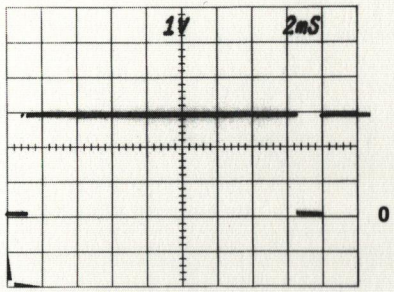




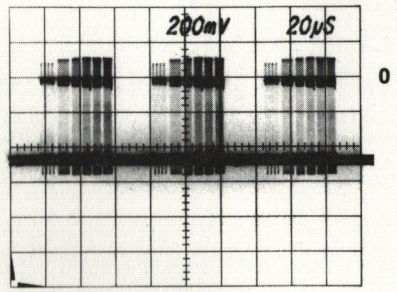
*See Parts List for serial number ranges.

A6 FUNCTION GEN BOARD

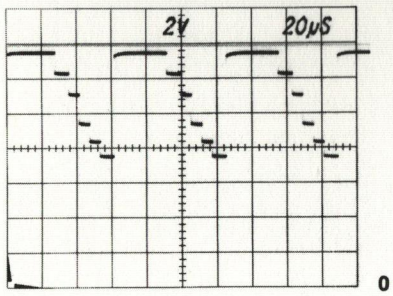
14 WAVEFORMS



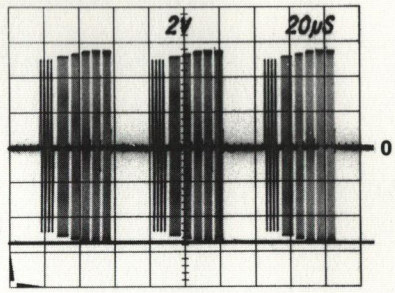
1



3

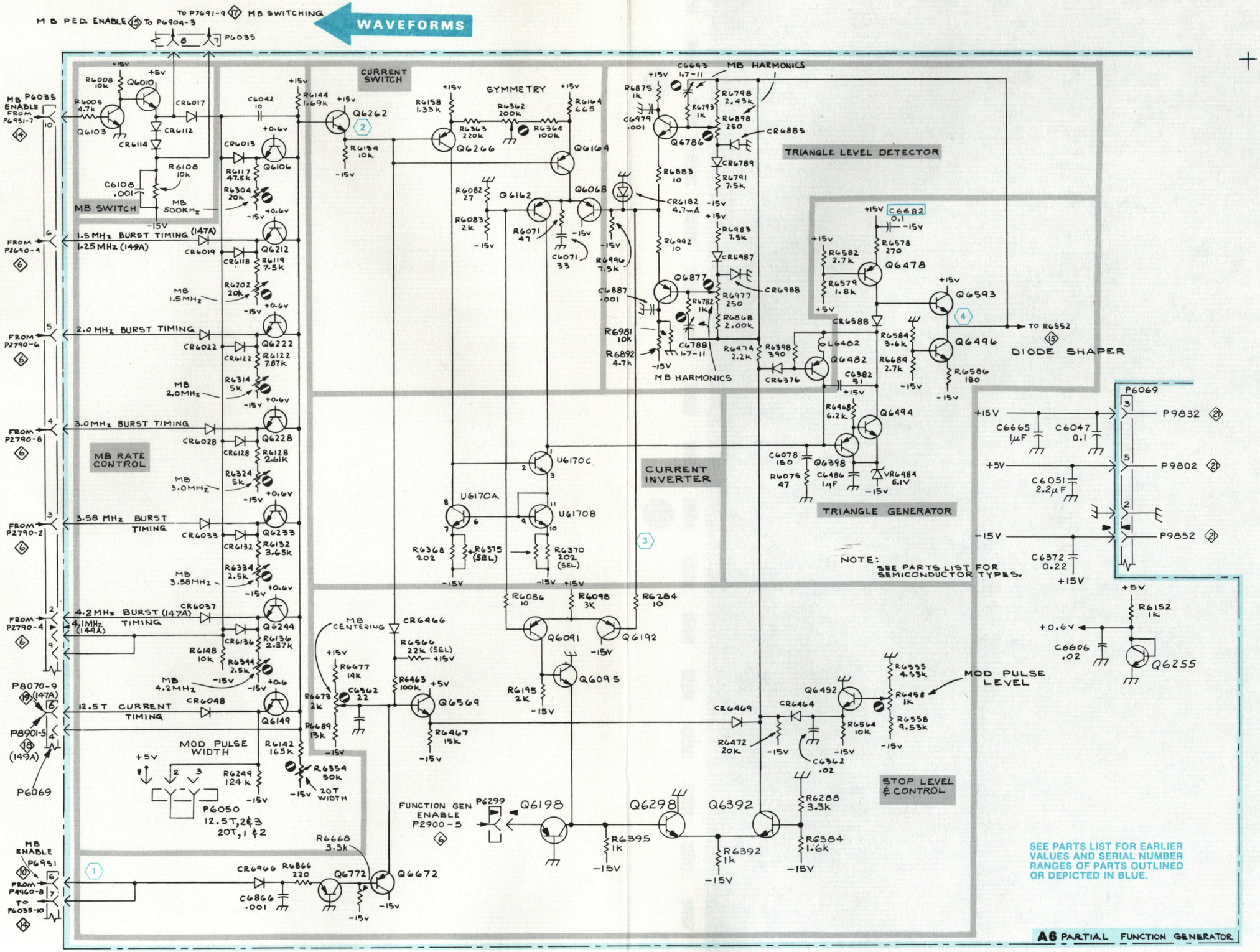


2



4

Waveforms and Voltages obtained under conditions given on Diagram Title page except: All waveforms, DTM set to view any active line within the field and the FULL FIELD SIG Mode switch set to MULTIBURST.

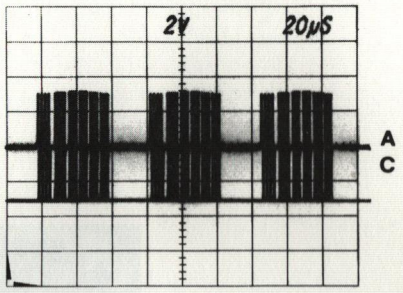


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REV. A, JAN. 1977

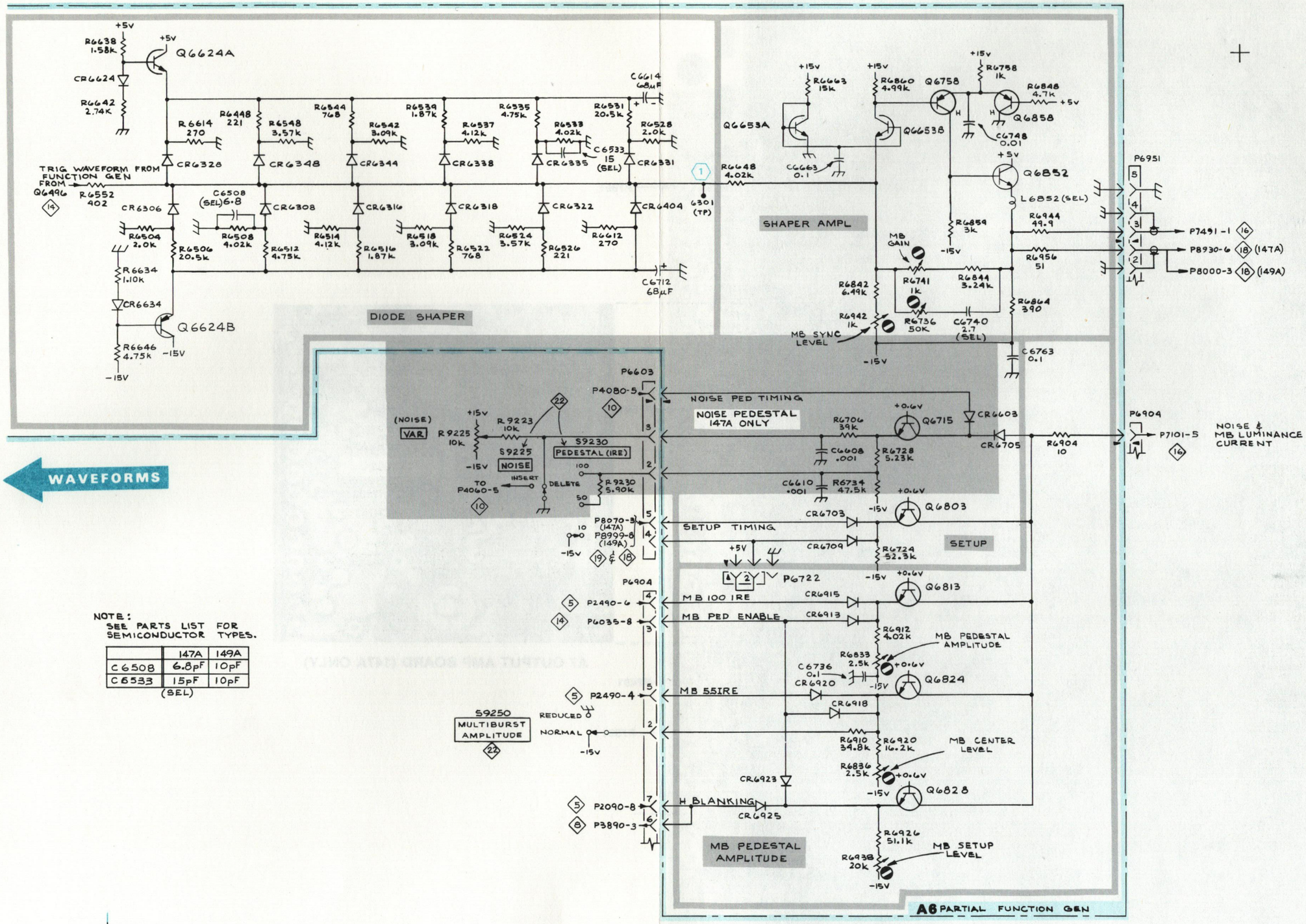
147A/149A

FUNCTION GENERATOR 14

15
WAVEFORMS



Waveforms and Voltages obtained under conditions given on Diagram Title page except: All waveforms, DTM set to view any active line within the field and the FULL FIELD SIG Mode switch set to MULTIBURST.

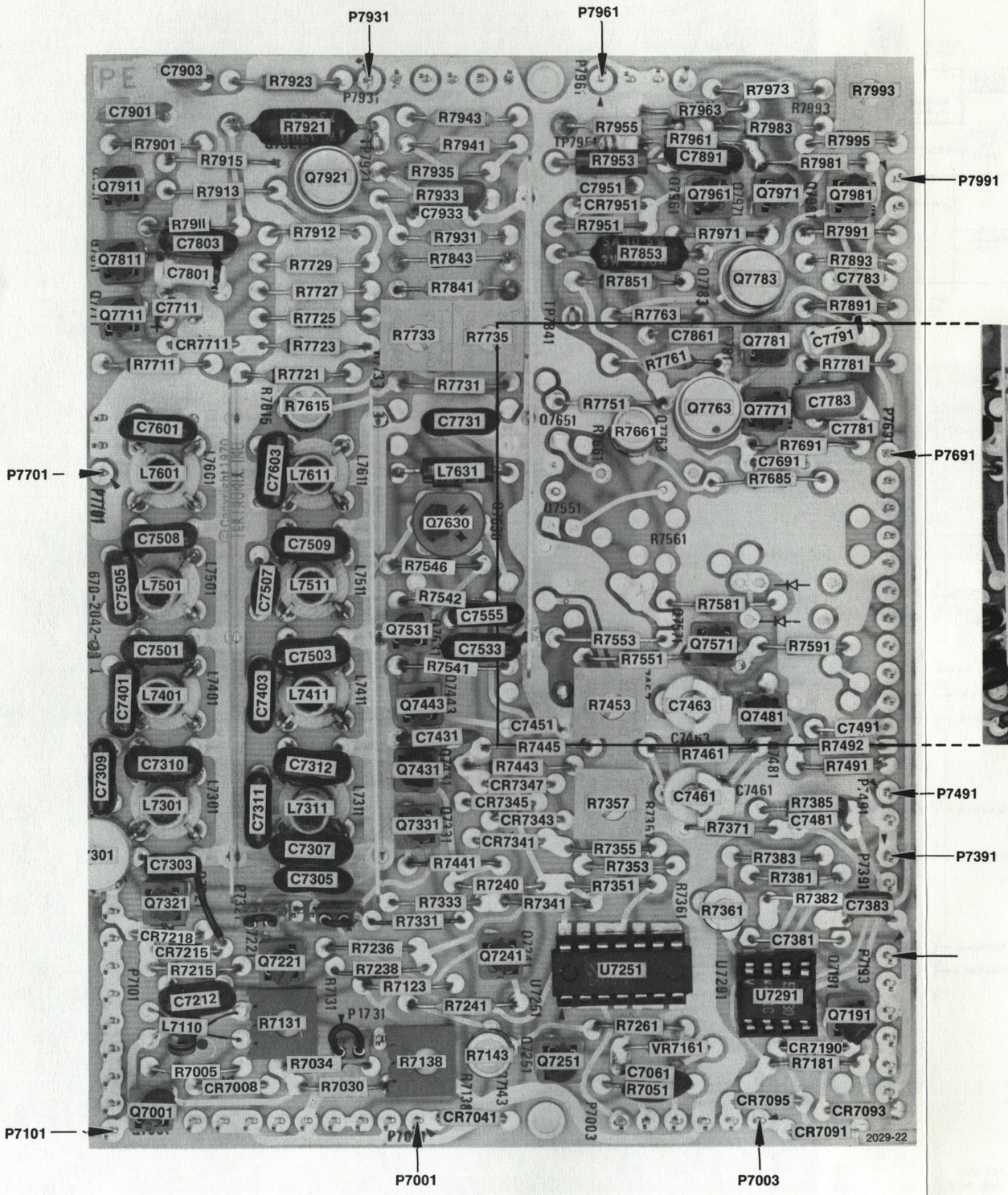


WAVEFORMS

NOTE:
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

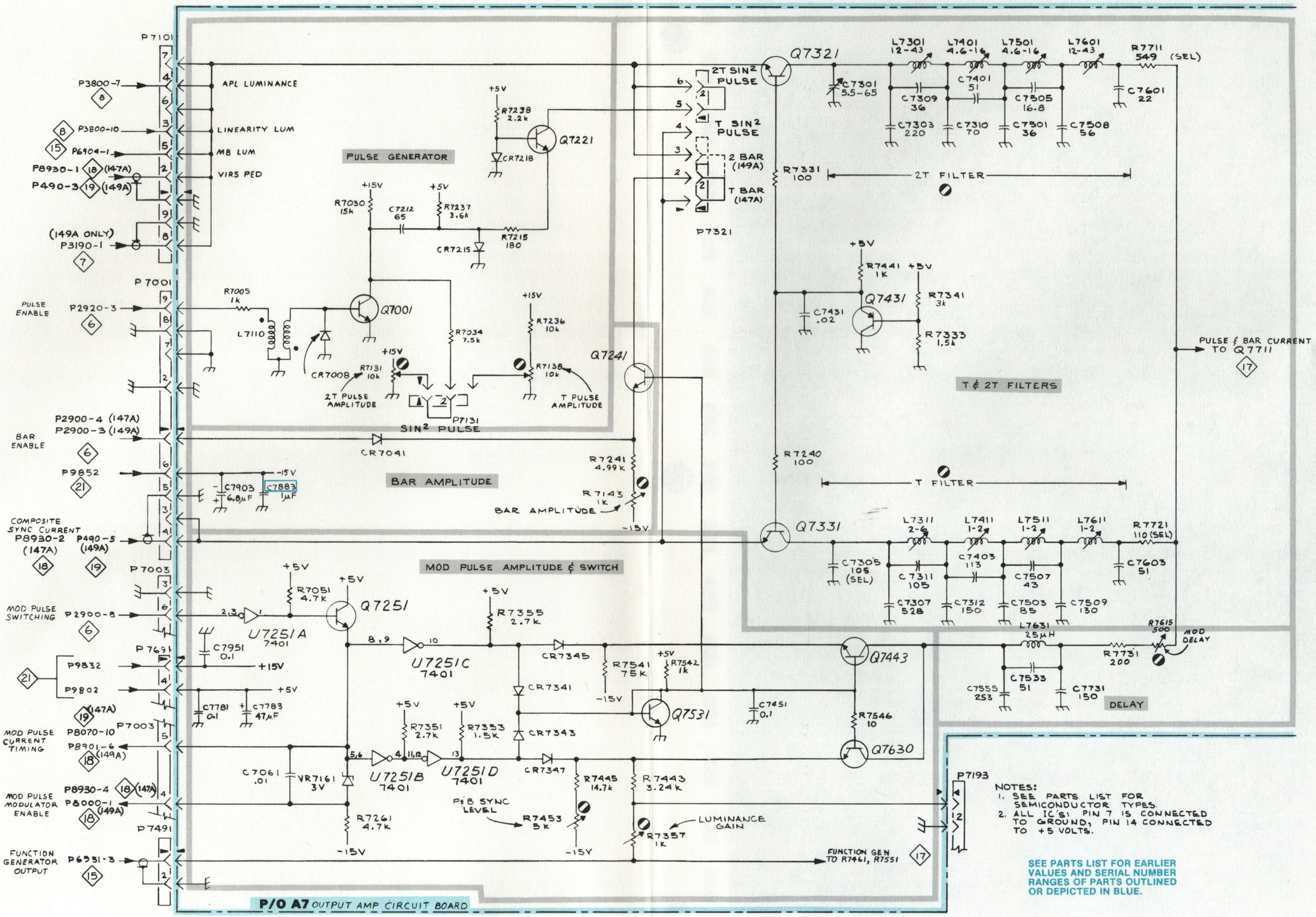
	147A	149A
C6508	6.8pF	10pF
C6533	15pF (SEL)	10pF

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REV. A, JAN. 1977



A7 OUTPUT AMP BOARD (149A ONLY)

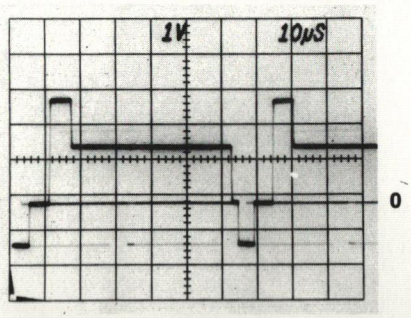
A7 OUTPUT AMP BOARD (147A ONLY)



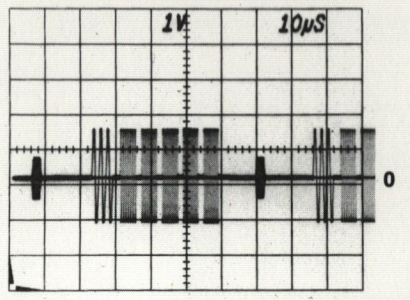
147A/149A

2029-155
REV. A, JAN. 1977

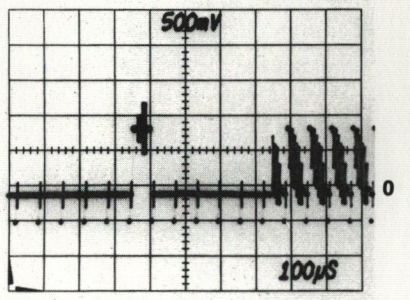
17
WAVEFORMS



1

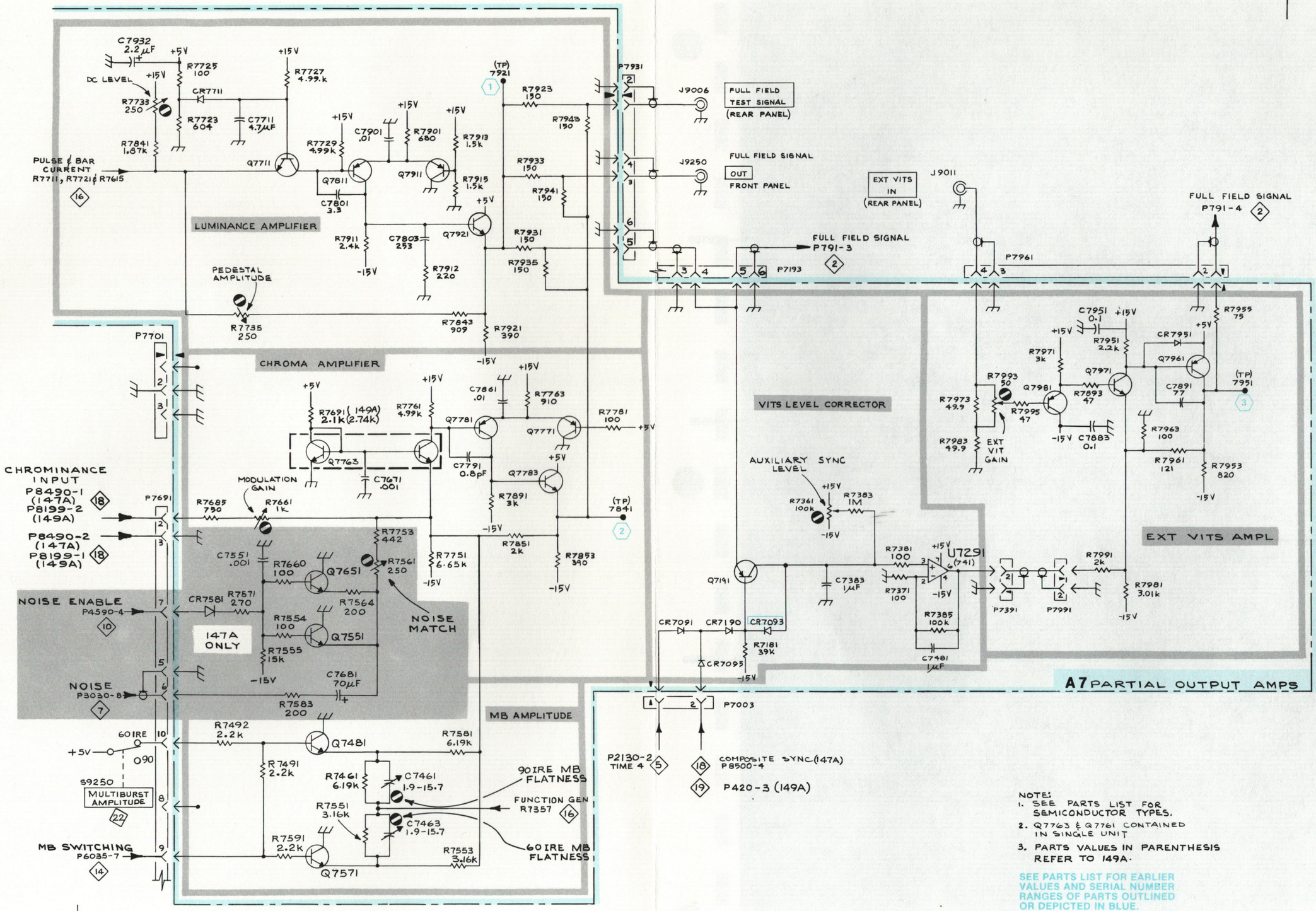


2



3

Waveforms and Voltages obtained under conditions given on Diagram Title page except: Multiburst switched in.

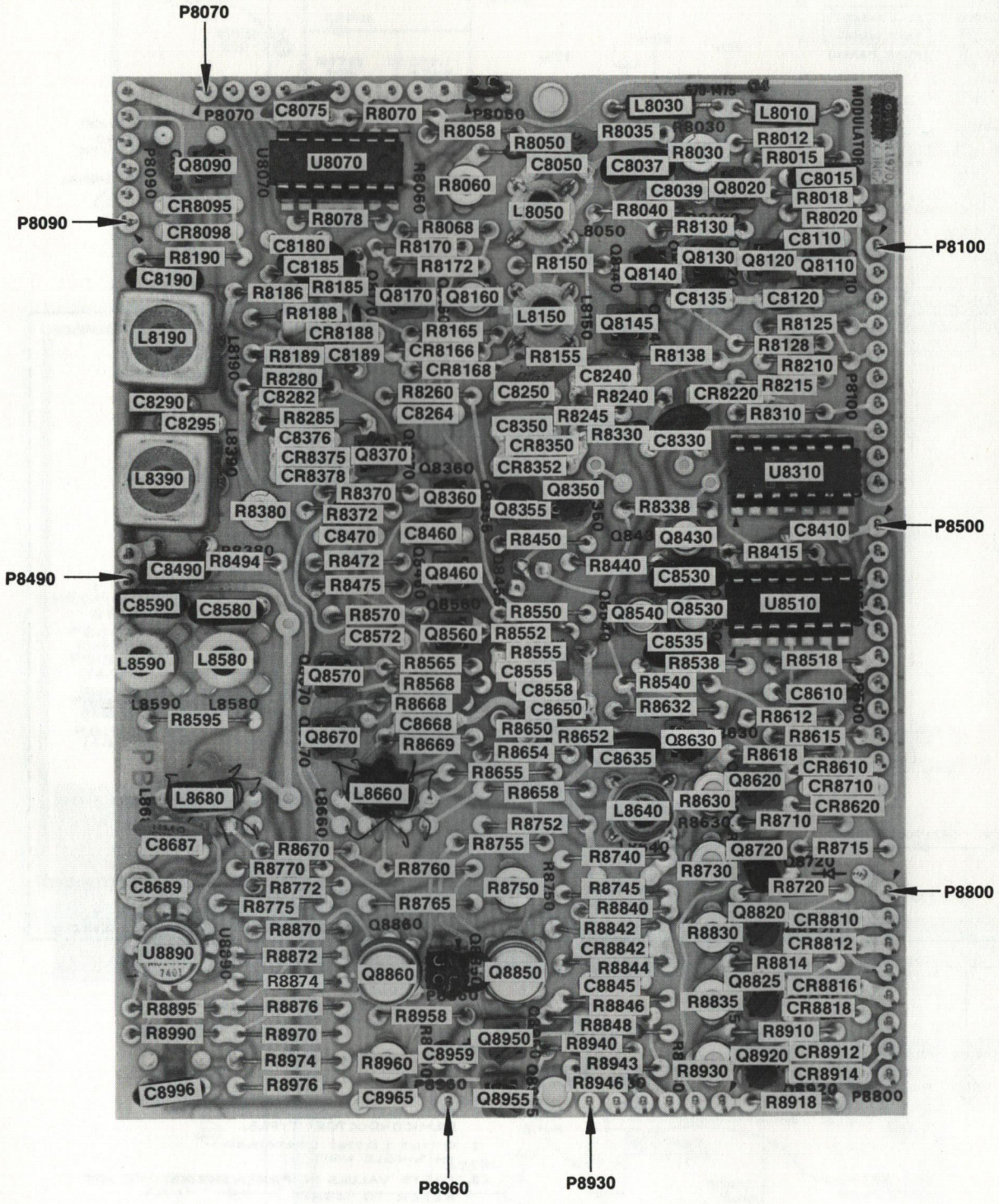


NOTE:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. Q7763 & Q7761 CONTAINED IN SINGLE UNIT
3. PARTS VALUES IN PARENTHESIS REFER TO 149A.

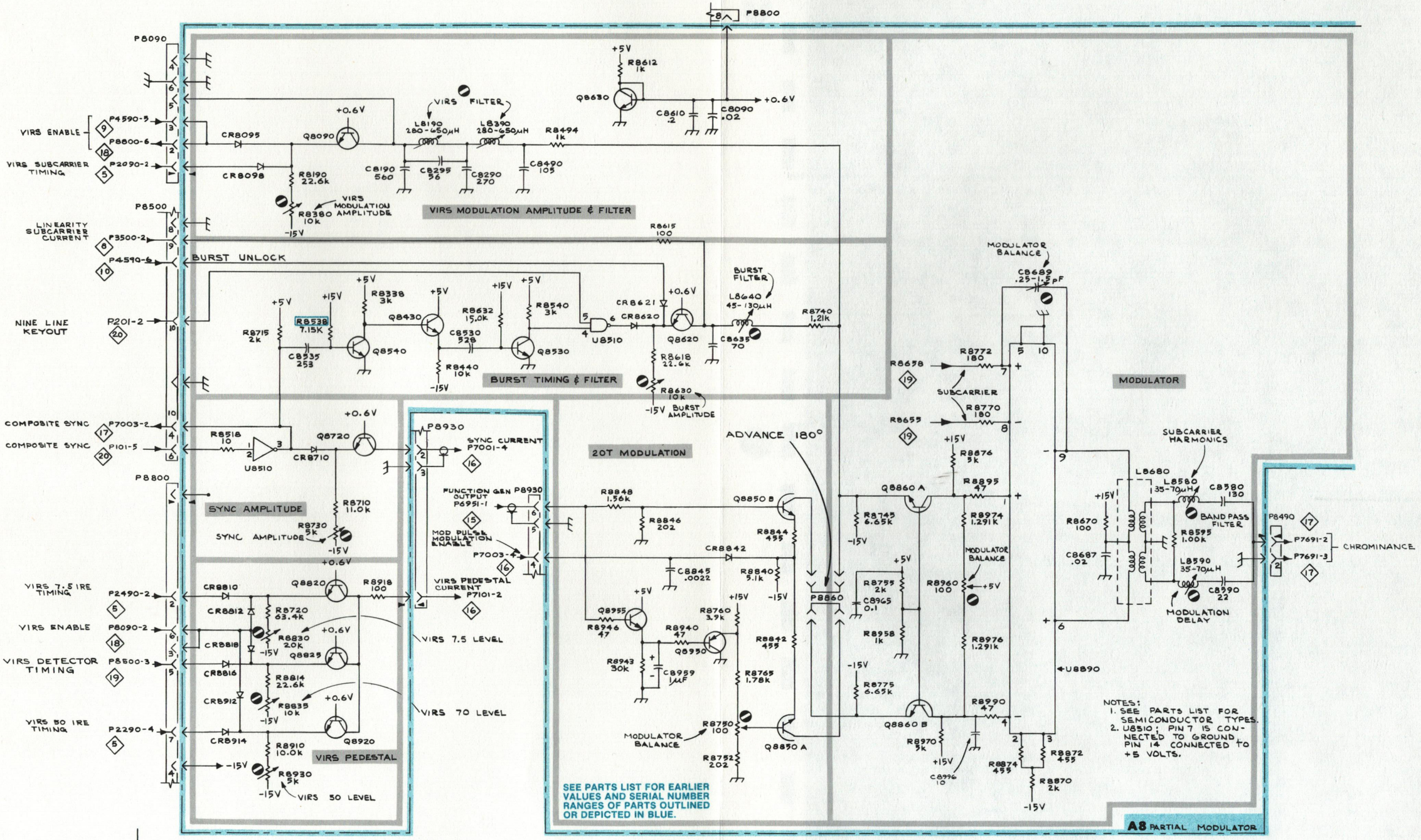
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.

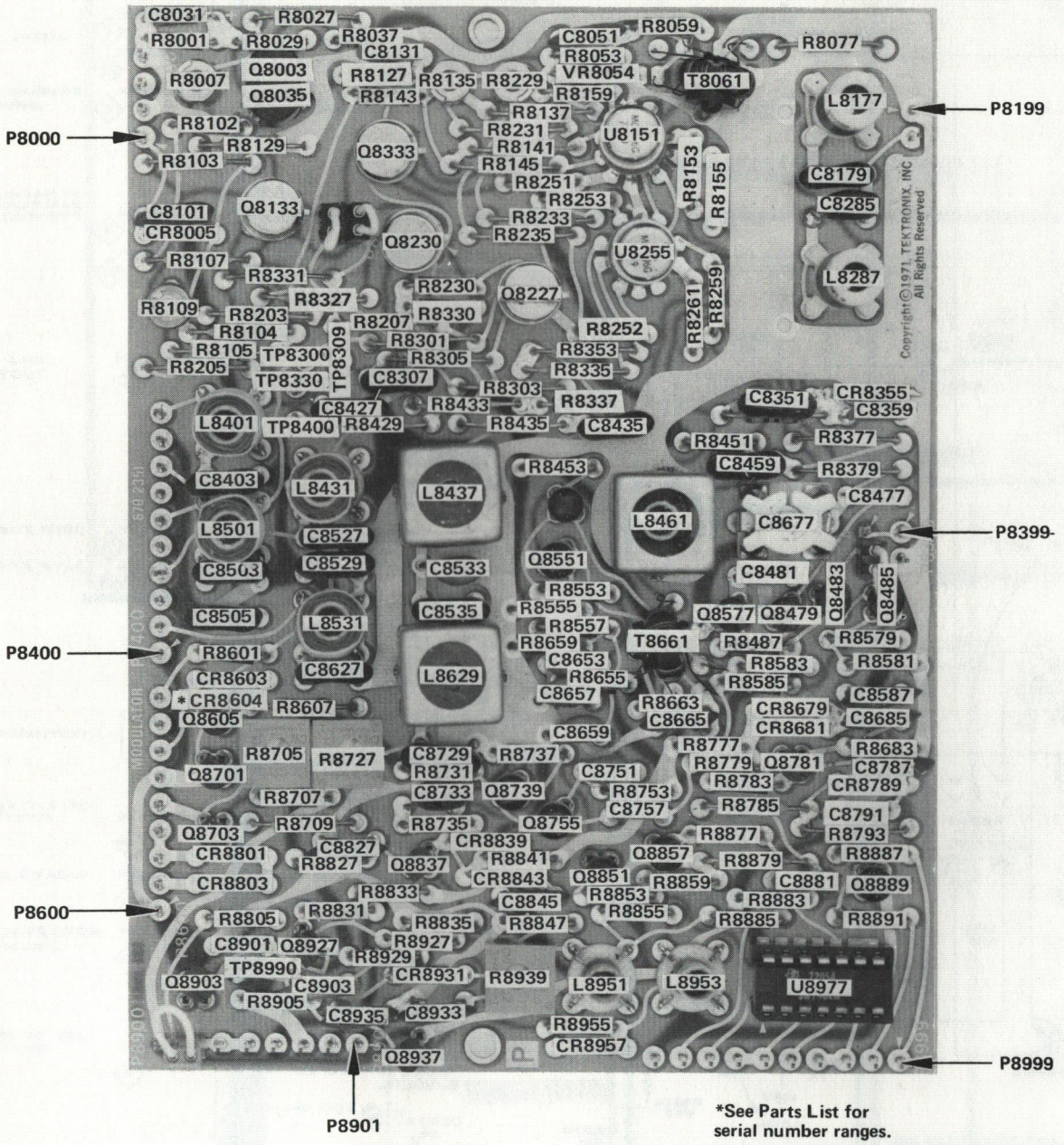
147A/149A

OUTPUT AMPLIFIERS 17



A8 MODULATOR BOARD (147A ONLY)


P8800
P8090
VIRS ENABLE
P4590-5
P8600-6
VIRS SUBCARRIER TIMING
P2090-2
CR8095
CR8098
Q8090
+0.6V
VIRS FILTER
L8190 280-650µH
L8390 280-650µH
R8494 1k
C8190 560
C8295 56
C8290 270
C8490 105
R8190 22.6k
R8380 10k
VIRS MODULATION AMPLITUDE
-15V
VIRS MODULATION AMPLITUDE & FILTER
+5V
R8612 1k
Q8630
C8610 .2
C8090 .02
P8500
LINEARITY SUBCARRIER CURRENT
P3500-2
P4590-6
BURST UNLOCK
R8615 100
NINE LINE KEYOUT
P201-2
R8715 2k
R8538 7.15K
C8535 253
R8338 3k
Q8540
Q8430
C8530 528
R8440 10k
R8632 15.0k
R8540 3k
Q8530
U8510
CR8621
CR8620
Q8620
BURST FILTER
L8640 45-130µH
C8635 70
R8740 1.21k
R8618 22.6k
R8630 10k
BURST AMPLITUDE
BURST TIMING & FILTER
MODULATOR BALANCE
C8689 .25-1.5pF
R8658
R8772 180
SUBCARRIER
R8770 180
R8655
MODULATOR
COMPOSITE SYNC
P7003-2
P101-5
R8518 10
U8510
Q8720
CR8710
SYNC AMPLITUDE
R8710 11.0k
R8730 5k
SYNC AMPLITUDE
P8930
SYNC CURRENT P7001-4
FUNCTION GEN P8930 OUTPUT P6951-1
MOD PULSE MODULATION ENABLE
P7003-4
VIRS PEDESTAL CURRENT P7101-2
VIRS 7.5 IRE TIMING
P2490-2
VIRS ENABLE
P8090-2
VIRS DETECTOR TIMING
P8500-3
VIRS 50 IRE TIMING
P2290-4
CR8810
CR8812
CR8818
CR8816
CR8912
CR8914
Q8820
Q8825
Q8920
R8720 63.4k
R8830 20k
R8814 22.6k
R8835 10k
R8910 10.0k
R8930 5k
R8918 100
VIRS 7.5 LEVEL
VIRS 70 LEVEL
VIRS PEDESTAL
VIRS 50 LEVEL
20T MODULATION
ADVANCE 180°
R8848 1.56k
R8846 202
Q8850 B
R8844 455
CR8842
C8845 .0022
R8840 5.1k
Q8955
R8946 47
R8943 30k
C8959 1µF
R8940 47
Q8950
R8760 3.9k
R8842 455
R8765 1.78k
R8750 100
R8752 202
Q8850 A
MODULATOR BALANCE
P8860
R8745 6.65k
Q8860 A
R8755 2k
C8965 0.1
R8958 1k
R8775 6.65k
Q8860 B
R8970 5k
C8996 10
R8895 47
R8974 1.291k
MODULATOR BALANCE
R8960 100
R8976 1.291k
R8990 47
R8874 455
R8872 455
R8870 2k
U8890
SUBCARRIER HARMONICS
L8680
L8580 35-70µH
C8580 130
BAND PASS FILTER
R8595 1.00k
L8590 35-70µH
C8590 22
MODULATION DELAY
R8670 100
C8687 .02
P8490
P7691-2
P7691-3
CHROMINANCE
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. U8510; PIN 7 IS CONNECTED TO GROUND, PIN 14 CONNECTED TO +5 VOLTS.
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.
A8 PARTIAL MODULATOR

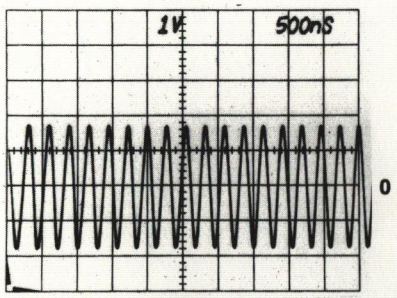


*See Parts List for serial number ranges.

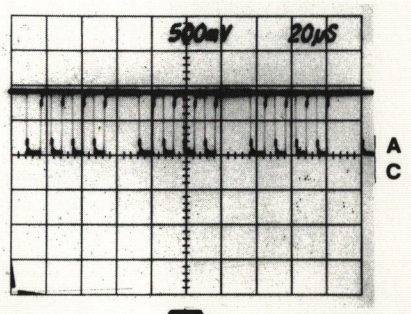
A8 MODULATOR BOARD (149A ONLY)

18 WAVEFORMS

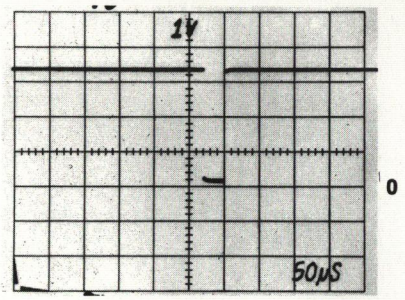
(149A ONLY)



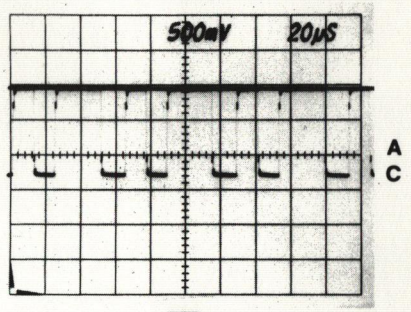
1



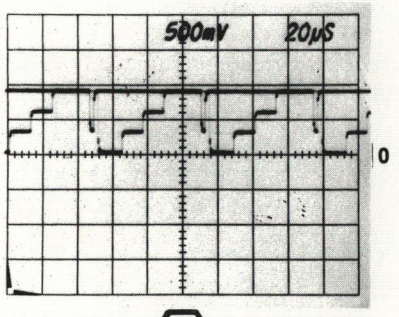
4



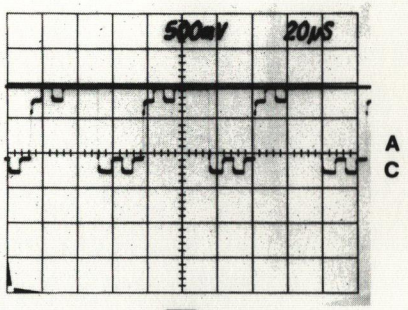
2



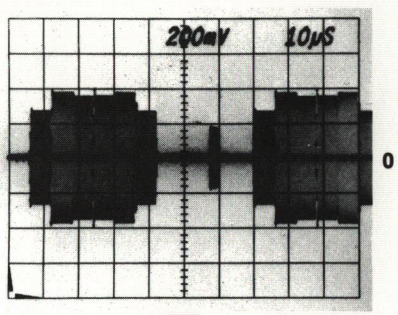
5



3



6



7

Waveforms and Voltages obtained under conditions given on the Diagram Title page except: FULL FIELD SIG Mode switch set to COLOR TEST SIGNAL.

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN BLUE.

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. ALL IC'S: PIN 7 IS CONNECTED TO GROUND, PIN 14 IS CONNECTED TO +5 VOLTS.

VIRS MODULATION AMPLITUDE & FILTER
VIRS ENABLE
VIRS SUBCARRIER TIMING
VIRS FILTER
VIRS GAIN
TO U457 1C VITS FF
BURST TIMING P401-8
LIN SUB CURRENT P3500-2
BURST GAIN
BURST AMPLITUDE
-(B-Y) FILTER
-(B-Y) P3040-2
B-Y FILTER
+(B-Y) P3040-2
+(B-Y) FILTER
FIELD VARIABLE PHASE
MOD PULSE MODULATION ENABLE
FUNCTION GEN OUTPUT
MOD PULSE PHASE
FIELD PHASE
PHASE MOD FILTERS
SUBCARRIER P298-10
MOD PULSE CURRENT TIMING
FIELD FIXED PHASE
INSERT SUBCARRIER PHASE
FIELD PHASE SWITCH
P/B ENABLE P4960-4
H BLANKING
COMPOSITE SETUP TIMING
COMPOSITE ENABLE
SETUP TIMING
MOD PULSE MODULATION
MOD PULSE PHASE REVERSAL
P/B MOD PED
SIN CHROMA GAIN
AGC
180° PHASE SWITCH
MOD PED CURRENT
+(R-Y) FILTER
-(R-Y) FILTER
R-Y FILTER
TO BASE Q8227
+8.2V FROM VR8054 (THIS PAGE)
COLOR BAR MOD BALANCE
MODULATOR
90° QUAD PHASE
BAND PASS FILTER L8287 35-70μH
BAND PASS FILTER L8177 35-70μH
CHROMINANCE P8199
180° SWITCH PHASE
FLAT FIELD MOD BAL
TO R8135 THIS PAGE
TO BASE OF Q8333
A8 MODULATOR CIRCUIT BOARD

149A

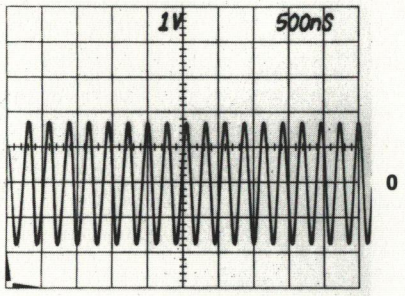
(1646)2029-158
REV.A, JAN. 1977

MODULATOR 18

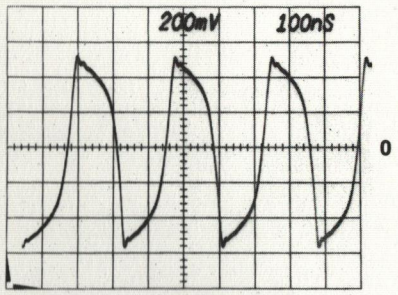
19

WAVEFORMS

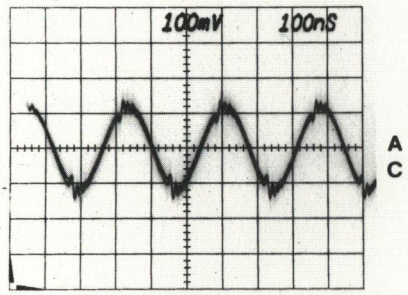
(147A ONLY)



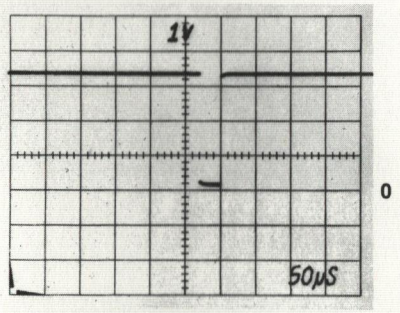
1



3

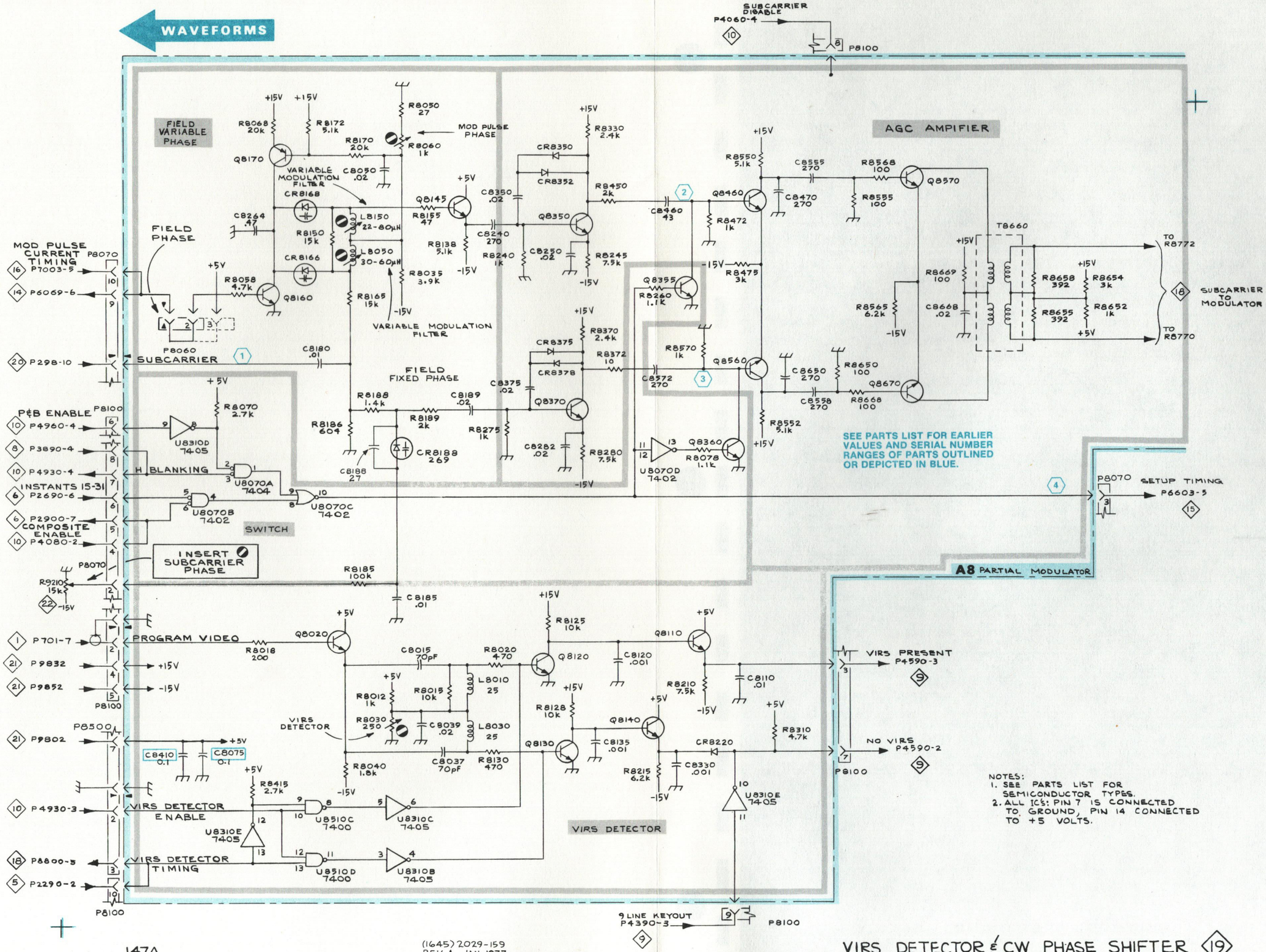


2



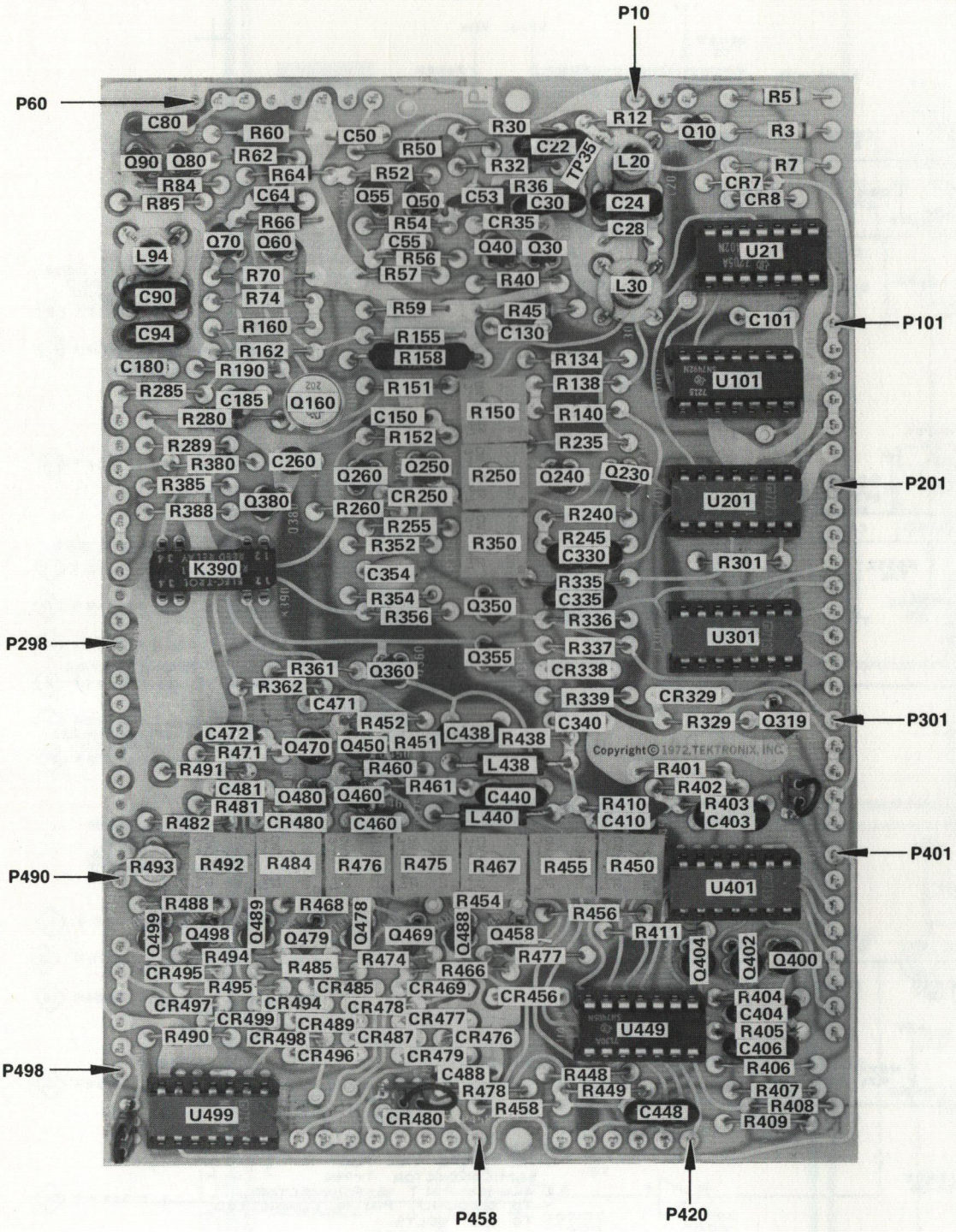
4

Waveforms and Voltages obtained under conditions given on the Diagram Title page except: FULL FIELD SIG Mode switch set to COLOR TEST SIGNAL.

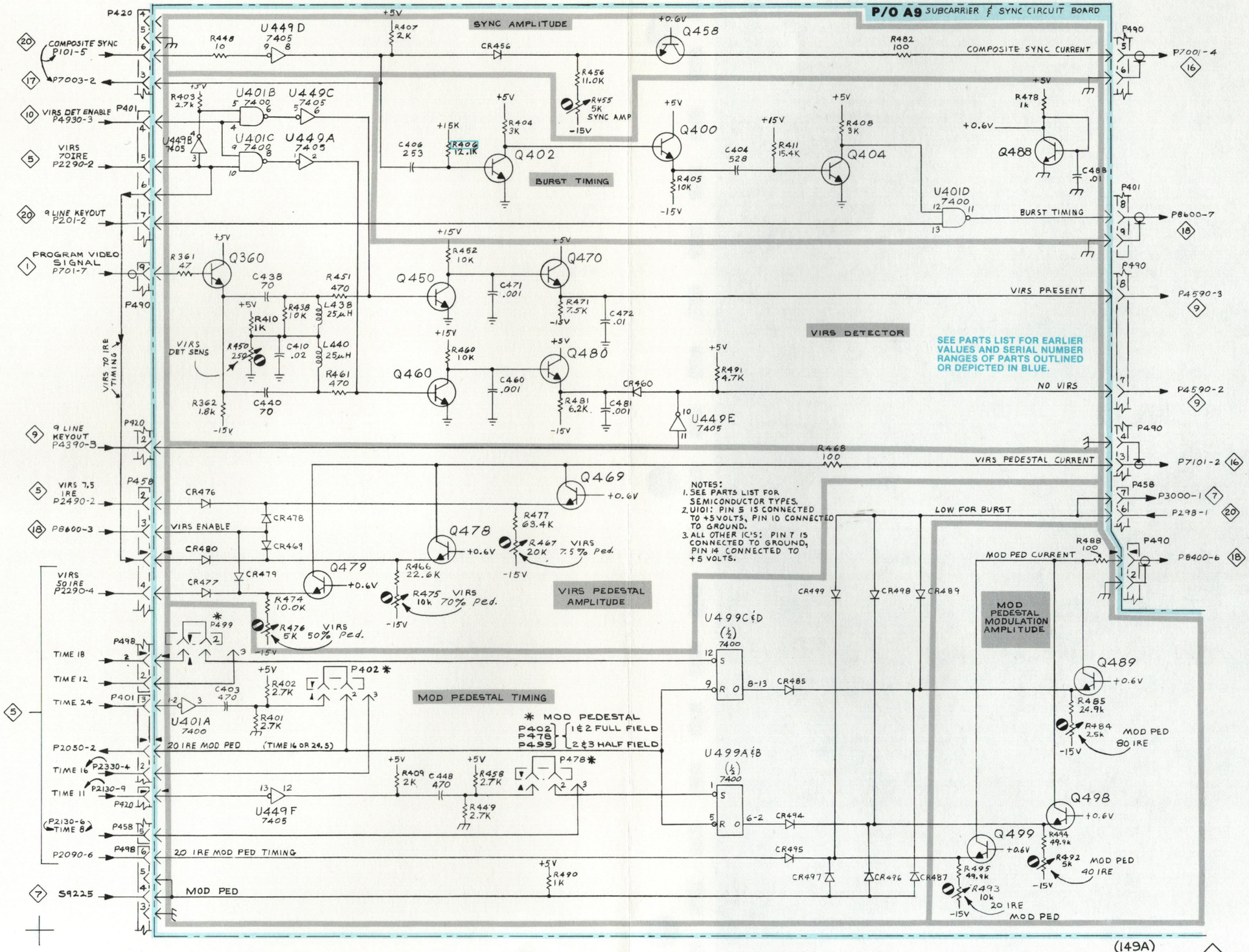


(1645) 2029-159
REV. A, JAN. 1977

VIRS DETECTOR & CW PHASE SHIFTER 19



A9 SUBCARRIER & SYNC BOARD (149A ONLY)

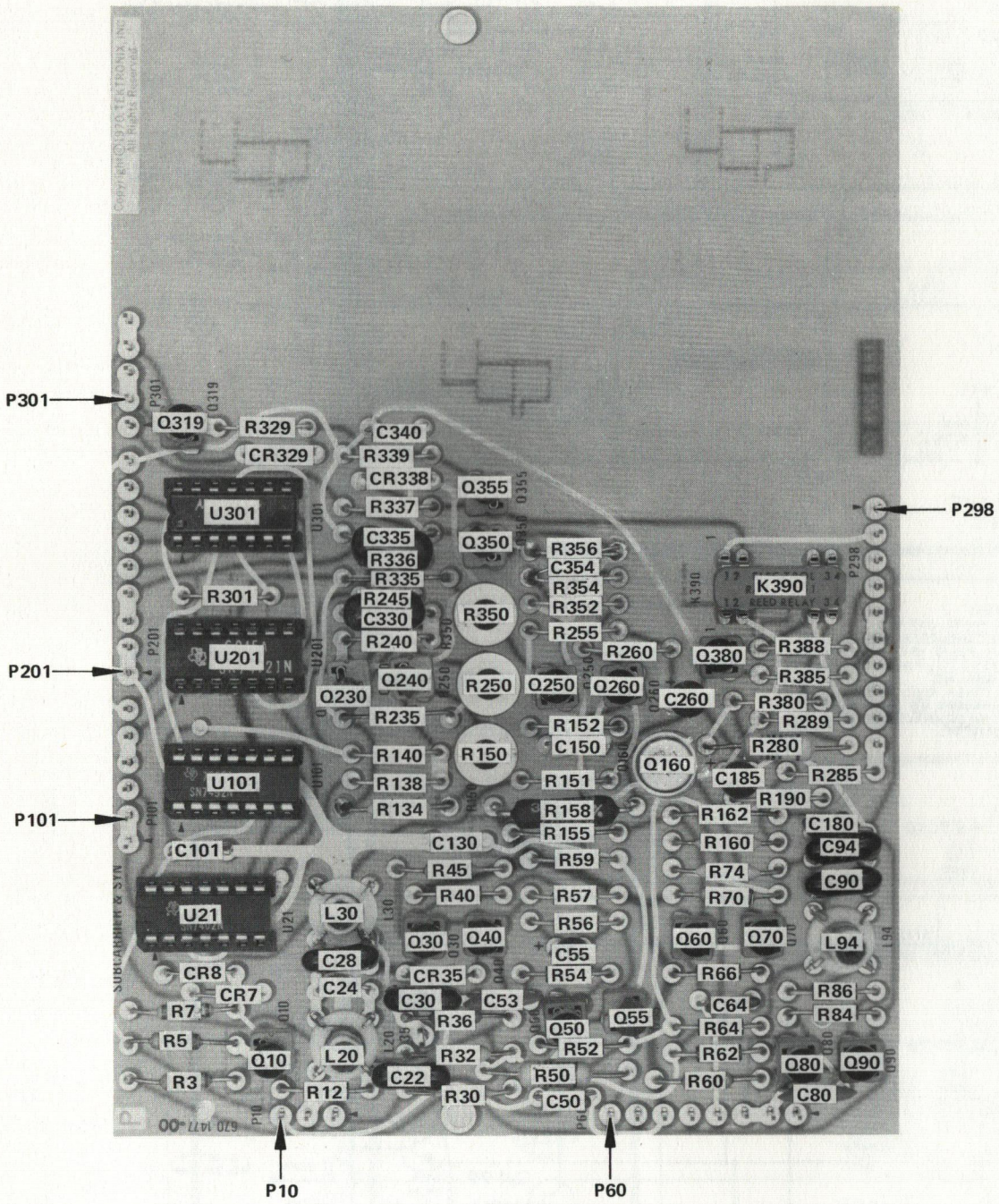


149A/147A

(1646)2029-160
REV NOV 1981

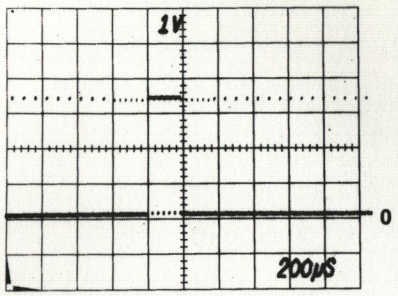
(149A)

VIRS DETECT, MOD PEDESTAL, SUBC & SYNC OUT 19

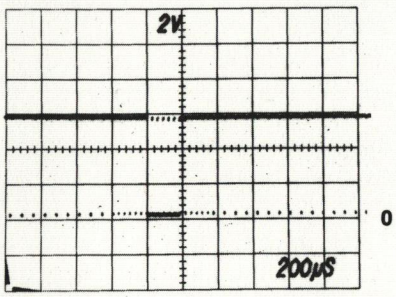


A9 SUBCARRIER & SYNC BOARD (147A ONLY)

20
WAVEFORMS

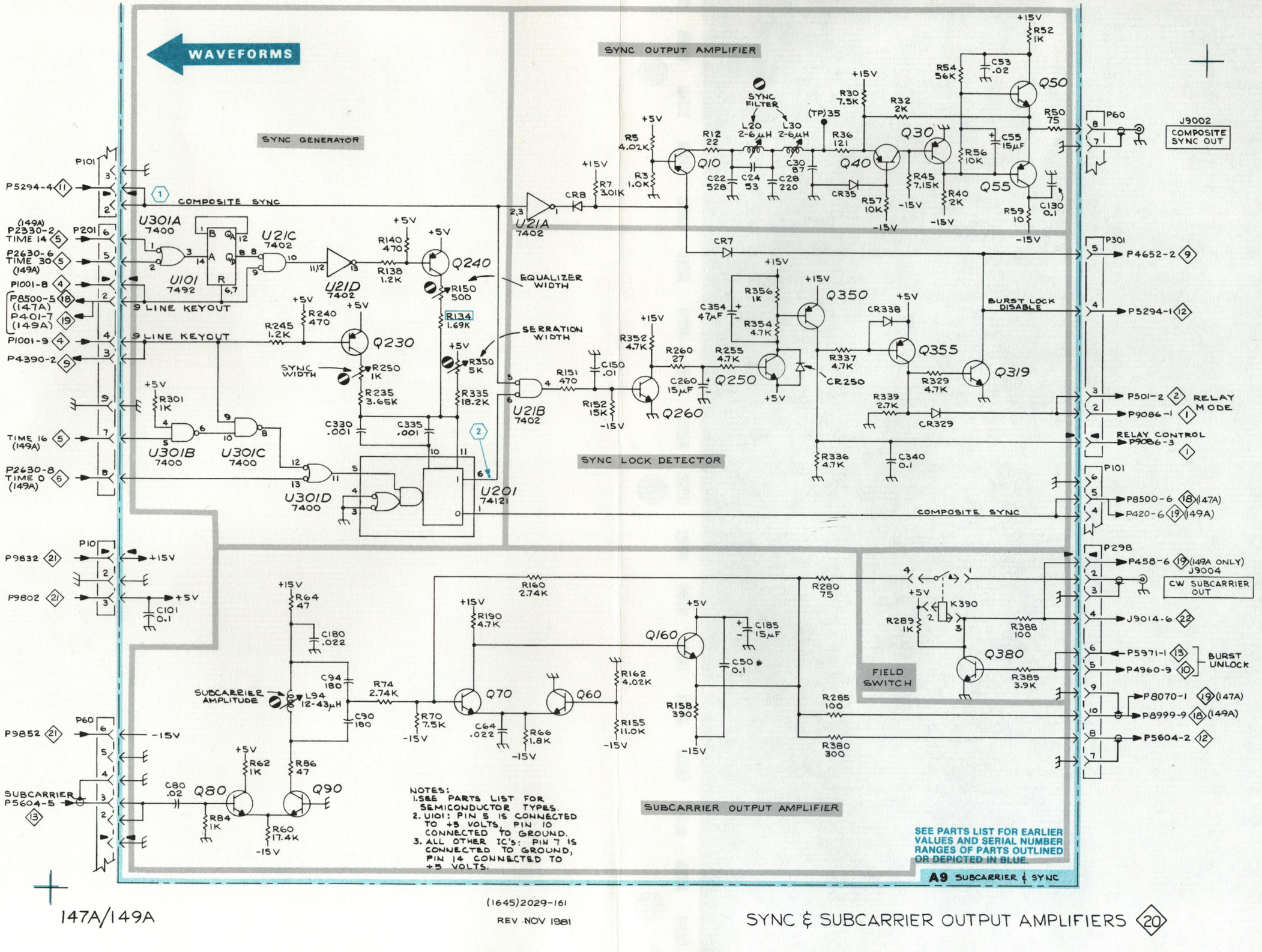


1



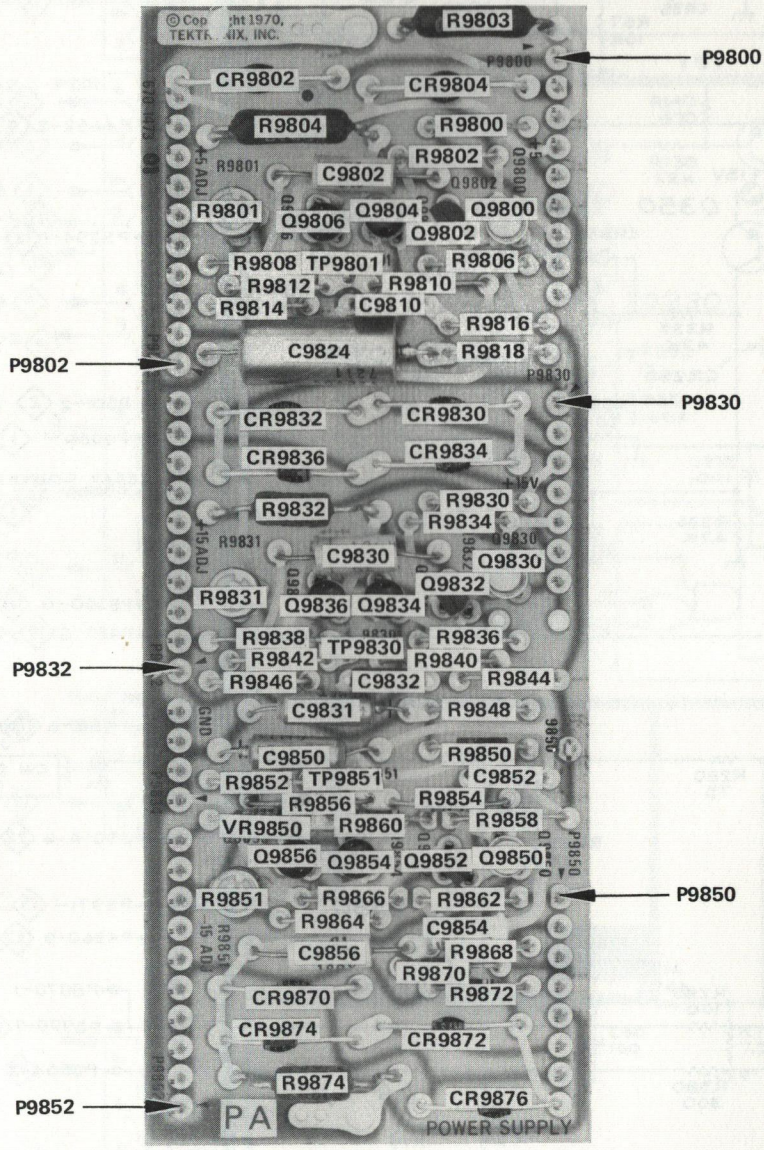
2

Waveforms and Voltages obtained under conditions given on the Diagram Title page.

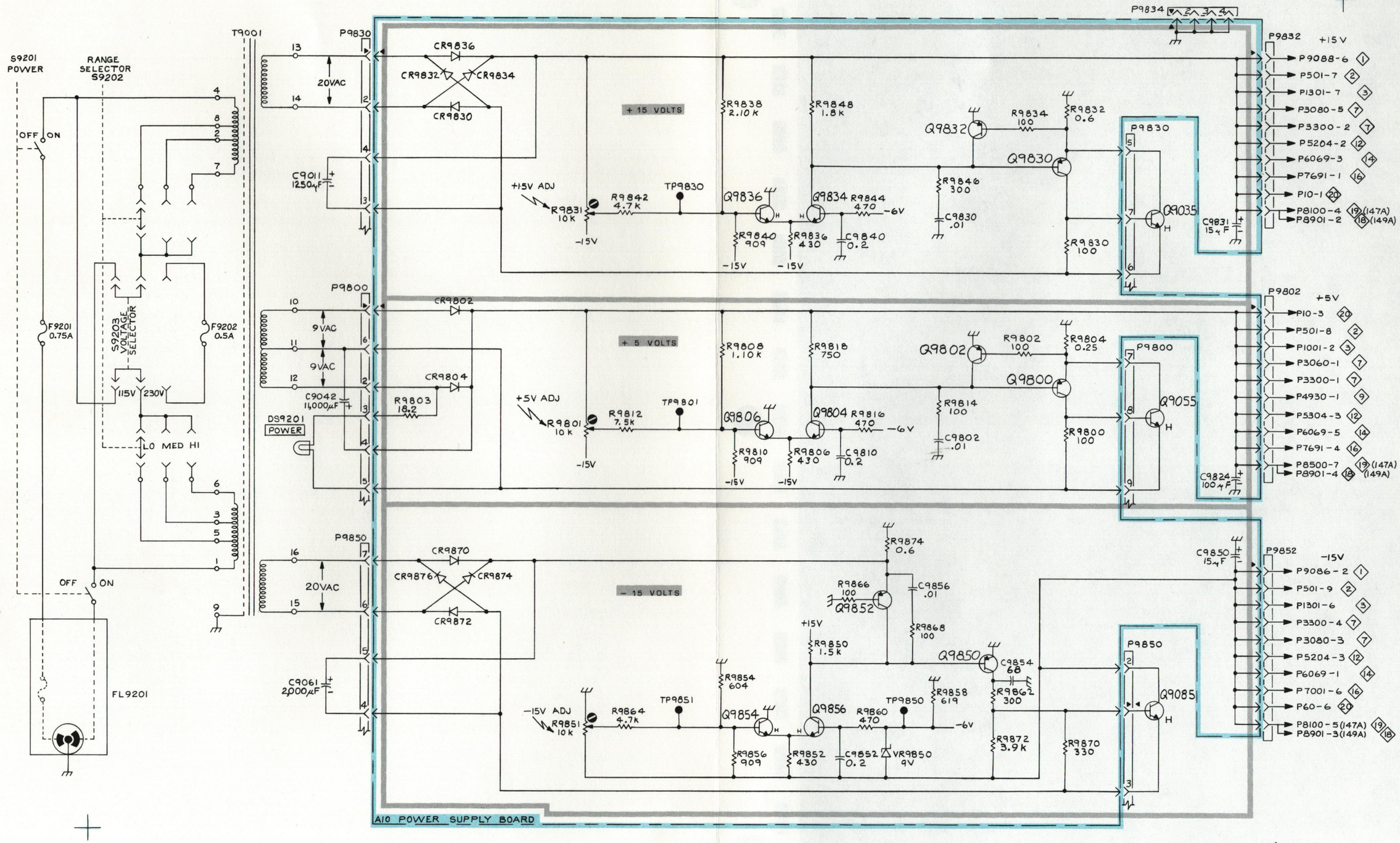


(1645)2029-161
REV NOV 1981

SYNC & SUBCARRIER OUTPUT AMPLIFIERS 20



A10 POWER SUPPLY BOARD

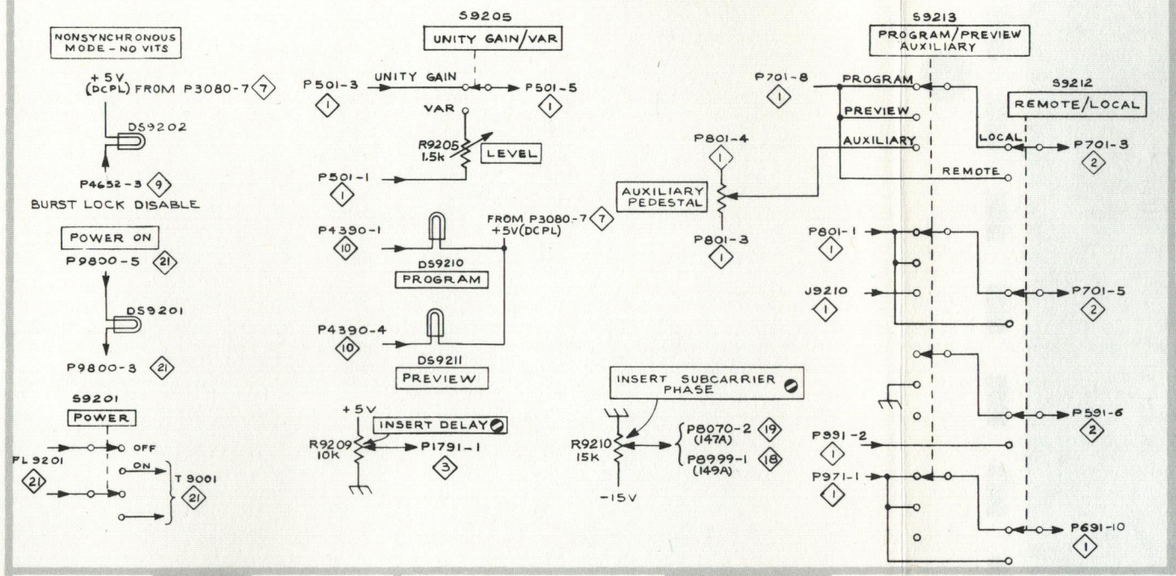


147A/149A

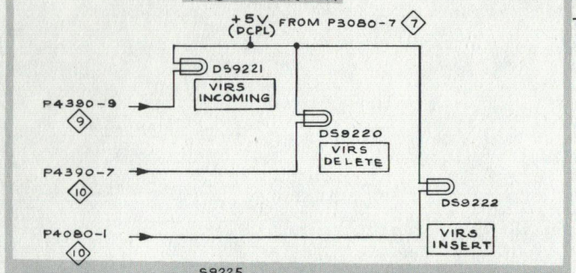
2029-162
REV. NOV 1981

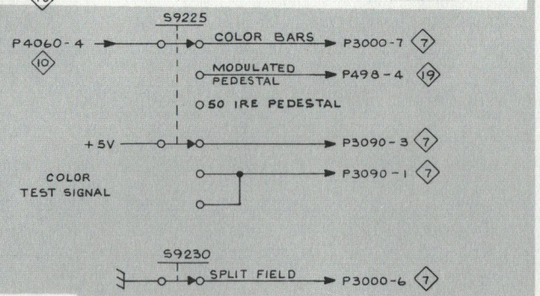
POWER SUPPLY 21

PROGRAM CONTROL

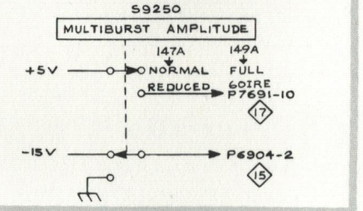


VITS INSERTION

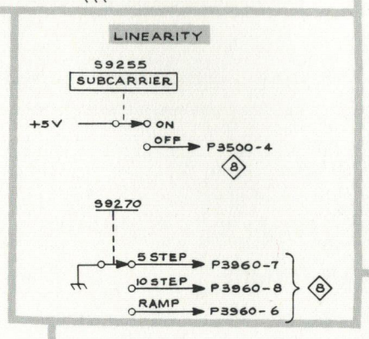




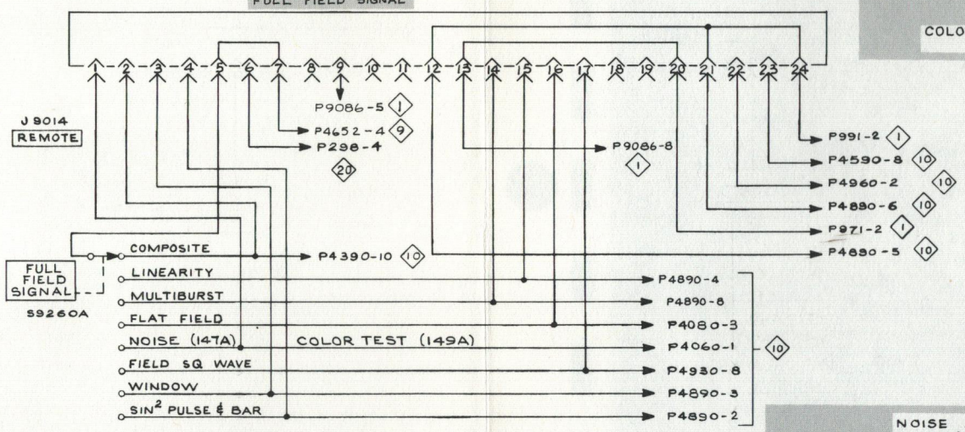
MULTIBURST

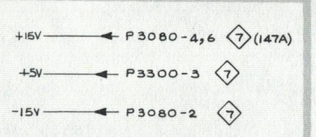


LINEARITY

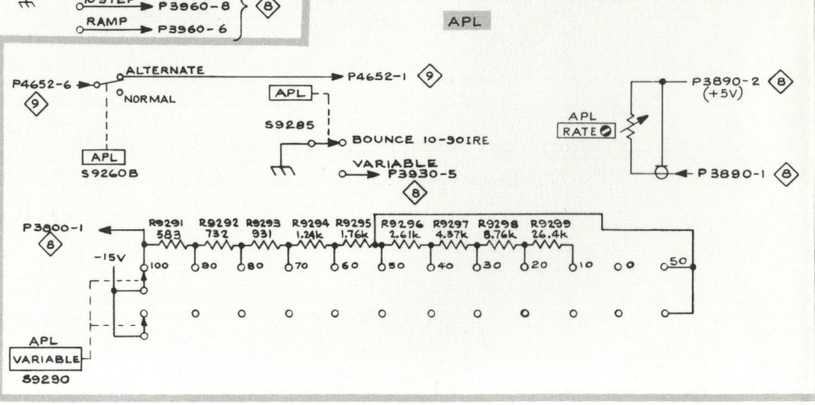


FULL FIELD SIGNAL



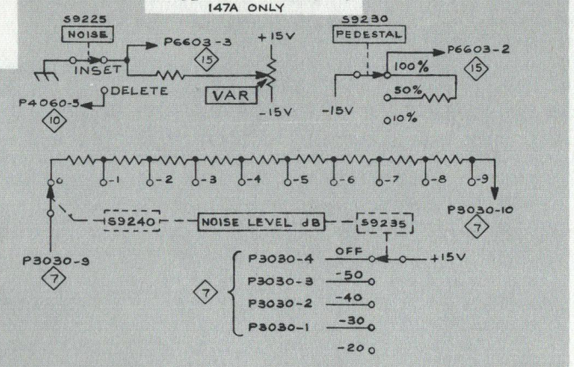


APL



NOISE AND PEDESTAL

147A ONLY



REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 *Name & Description*

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

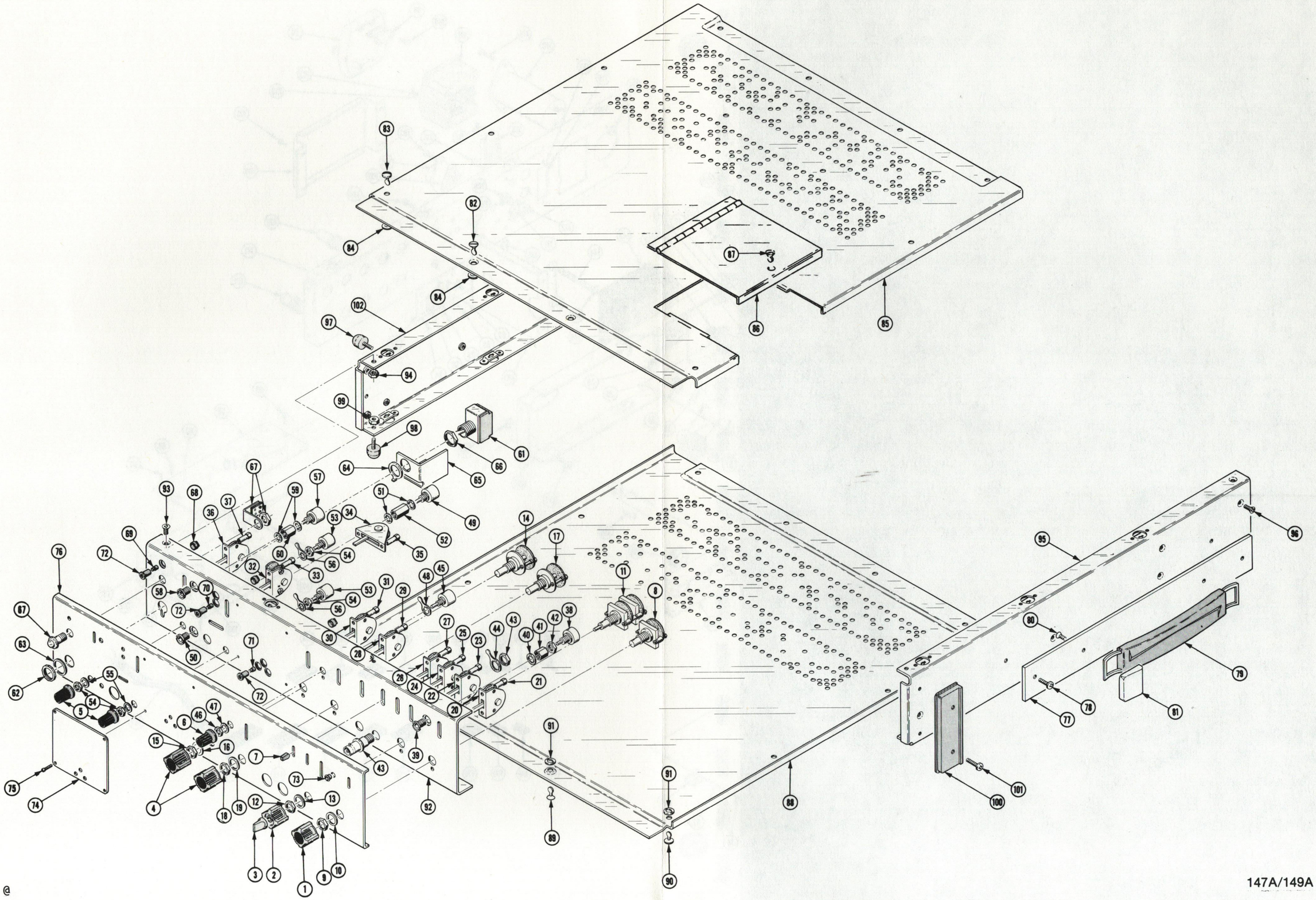
Mfr. Code	Manufacturer	Address	City, State, Zip
S3109	FELLER ASA ADOLF AG., C/O PANEL COMPONENTS CORP.	355 TESCONI CIRCLE	SANTA ROSA, CA 95401
000CY	NORTHWEST FASTENER SALES, INC.	7923 SW CIRRUS DRIVE	BEAVERTON, OR 97005
000JG	SOUND MFG	12115 E MARGINAL WAY SOUTH	SEATTLE, WA 98168
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
06666	GENERAL DEVICES CO., INC.	525 S. WEBSTER AVE.	INDIANAPOLIS, IN 46219
09422	PLASTIC STAMPING CORPORATION	2216 W. ARMITAGE AVE.	CHICAGO, IL 60647
11897	PLASTIGLIDE MFG. CORPORATION	P O BOX 867, 1757 STANFORD ST.	SANTA MONICA, CA 90406
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
12360	ALBANY PRODUCTS CO., DIV. OF PNEUMO DYNAMICS CORPORATION	145 WOODWARD AVENUE	SOUTH NORWALK, CT 06586
14566	COORS PORCELAIN COMPANY	600 9TH STREET	GOLDEN, CO 80401
16428	BELDEN CORP.	P. O. BOX 1331	RICHMOND, IN 47374
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
24931	SPECIALITY CONNECTOR CO., INC.	2620 ENDRESS PLACE	GREENWOOD, IN 46142
27193	CUTLER-HAMMER, INC. SPECIALTY PRODUCTS DIVISION	4201 N. 27TH ST.	MILWAUKEE, WI 53216
57668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
70903	BELDEN CORP.	2000 S BATAVIA AVENUE	GENEVA, IL 60134
71744	CHICAGO MINIATURE LAMP WORKS	4433 RAVENSWOOD AVE.	CHICAGO, IL 60640
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
74921	ITEN FIBRE CO.,	4001 BENEFIT AVE., P O BOX 9	ASHTABULA, OH 44004
77132	DOT FASTENER CO., A UNITED-CARR DIV. OF TRW INC.	ROUND HOUSE INDL PK,PO BOX 710	WATERBURY, CT 06720
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
77820	BENDIX CORP., THE, ELECTRICAL COMPONENTS DIVISION	SHERMAN AVE.	SIDNEY, NY 13838
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
78471	TILLEY MFG. CO.	900 INDUSTRIAL RD.	SAN CARLOS, CA 94070
78488	STACKPOLE CARBON CO.		ST. MARYS, PA 15857
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80126	PACIFIC ELECTRICORD CO.	747 W. REDONDO BEACH,P O BOX 10	GARDENA, CA 90247
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
86445	PENN FIBRE AND SPECIALTY CO., INC.	2032 E. WESTMORELAND ST.	PHILADELPHIA, PA 19134
86928	SEASTROM MFG. COMPANY, INC.	701 SONORA AVENUE	GLENDALE, CA 91201
87308	N. L. INDUSTRIES, INC., SOUTHERN SCREW DIV.	P. O. BOX 1360	STATESVILLE, NC 28677
91836	KINGS ELECTRONICS CO., INC.	40 MARBLEDALE ROAD	TUCKAHOE, NY 10707
94222	SOUTHCO, INC.		LESTER, PA 19113
95712	BENDIX CORP., THE ELECTRICAL COMPONENTS DIV., MICROWAVE DEVICES PLANT	HURRICANE ROAD	FRANKLIN, IN 46131
98627	UNIVERSAL OIL PRODUCTS CO., MORPLEX DIV.	1300 MORPLEX DRIVE	LACROSSE, WI 54601

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	366-0500-00			1		KNOB:GRAY,4 SIDED	80009	366-0500-00
	213-0153-00			2		. SETSCREW:5-40 X 0.125,STL BK OXD,HEX SKT	000CY	OBD
-2	366-1037-00			1		KNOB:GRAY	80009	366-1037-00
	213-0153-00			2		. SETSCREW:5-40 X 0.125,STL BK OXD,HEX SKT	000CY	OBD
-3	366-1163-00			1		KNOB:LIGHT GRAY	80009	366-1163-00
	213-0153-00			1		. SETSCREW:5-40 X 0.125,STL BK OXD,HEX SKT	000CY	OBD
-4	366-0500-00			2		KNOB:GRAY,4 SIDED	80009	366-0500-00
	----- -----			-		(147A ONLY)		
	213-0153-00			4		. SETSCREW:5-40 X 0.125,STL BK OXD,HEX SKT	000CY	OBD
-5	366-1189-00			2		KNOB:GRAY	80009	366-1189-00
	213-0153-00			2		. SETSCREW:5-40 X 0.125,STL BK OXD,HEX SKT	000CY	OBD
-6	366-1189-00			1		KNOB:GRAY	80009	366-1189-00
	----- -----			-		(147A ONLY)		
	213-0153-00			1		. SETSCREW:5-40 X 0.125,STL BK OXD,HEX SKT	000CY	OBD
-7	366-0215-02			9		KNOB:LEVER SWITCH	80009	366-0215-02
-8	260-1374-00			1		SWITCH,ROTARY:1 SECT,12 POSN,30 DEG	80009	260-1374-00
						(ATTACHING PARTS)		
-9	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-10	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - - -		
-11	260-1587-00			1		SWITCH,ROTARY:1 SECT,12 POSN,45 DEG	80009	260-1587-00
						(ATTACHING PARTS)		
-12	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-13	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - - -		
-14	260-1252-00			1		SWITCH,ROTARY:1 SECT,5 POSN,45 DEG	80009	260-1252-00
	----- -----			-		(147A ONLY)		
						(ATTACHING PARTS)		
-15	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
	----- -----			-		(147A ONLY)		
-16	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
	----- -----			-		(147A ONLY)		
						- - - * - - -		
-17	260-1251-00			1		SWITCH,ROTARY:1 SECT,10 POSN,30 DEG	80009	260-1251-00
	----- -----			-		(147A ONLY)		
						(ATTACHING PARTS)		
-18	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
	----- -----			-		(147A ONLY)		
-19	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
	----- -----			-		(147A ONLY)		
						- - - * - - -		
-20	260-0731-00			1		SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
						(ATTACHING PARTS)		
-21	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-22	260-0621-00			1		SWITCH,LEVER:1 SECT,3 POSN,30 DEG	80009	260-0621-00
						(ATTACHING PARTS)		
-23	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-24	260-0731-00			1		SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
						(ATTACHING PARTS)		
-25	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-26	260-0664-00			1		SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0664-00
						(ATTACHING PARTS)		
-27	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-28	260-0621-00			1		SWITCH,LEVER:1 SECT,3 POSN,30 DEG	80009	260-0621-00
	----- -----			-		(147A ONLY)		
	260-0731-00			1		SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
	----- -----			-		(149A ONLY)		
						(ATTACHING PARTS)		
-29	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-30	260-0731-00			1		SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
	260-1494-00			1		SWITCH,LEVER:1 SECT,3 POSN,30 DEG	80009	260-1494-00
						(ATTACHING PARTS)		
-31	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-32	260-1249-00			1		SWITCH,LEVER:2 SECT,3 POSN,30 DEG	80009	260-1249-00
						(ATTACHING PARTS)		
-33	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-34	260-1248-00			1		SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-1248-00
						(ATTACHING PARTS)		
-35	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-36	260-0731-00			1		SWITCH,LEVER:1 SECT,2 POSN,30 DEG	80009	260-0731-00
						(ATTACHING PARTS)		
-37	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-38	----- -----			1		RESISTOR,VAR:(SEE R9280 REPL)		
						(ATTACHING PARTS)		
-39	358-0422-00			1		BSHG,MACH.THD:0.25-32 X 0.187" LONG BRS	80009	358-0422-00
-40	210-0046-00			1		WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS	78189	1214-05-00-0541C
-41	220-0484-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH AL	80009	220-0484-00
-42	210-0465-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH BRS	73743	3095-402
						- - - * - - -		
-43	131-0106-02			3		CONNECTOR,RCPT,:BNC	24931	28JR178-1
	----- -----			-		(147A ONLY)		
	131-0106-02			2		CONNECTOR,RCPT,:BNC	24931	28JR178-1
	----- -----			-		(149A ONLY)		
						(ATTACHING PARTS)		
-44	210-0255-00			1		TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	80009	210-0255-00
						- - - * - - -		
-45	----- ----			1		RESISTOR,VAR:(SEE R9225 REPL)		
	----- -----			-		(147A ONLY)		
						(ATTACHING PARTS)		
-46	210-0583-00			1		NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
	----- -----			-		(147A ONLY)		
-47	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
	----- -----			-		(147A ONLY)		
-48	210-0223-00			1		TERMINAL,LUG:0.25 INCH DIA,SE	86928	A313-136
	----- -----			-		(147A ONLY)		
						- - - * - - -		
-49	----- -----			1		RESISTOR,VAR:(SEE R9210 REPL)		
						(ATTACHING PARTS)		
-50	358-0409-00			1		BSHG,MACH.THD:0.25-32 X 0.159 ID X 0.24	80009	358-0409-00
-51	210-0046-00			2		WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS	78189	1214-05-00-0541C
-52	210-0471-00			1		NUT,SLEEVE:HEX.,0.312 X 0.594 INCH LONG	80009	210-0471-00
						- - - * - - -		
-53	----- -----			2		RESISTOR,VAR:(SEE R9205,R9215 REPL)		
						(ATTACHING PARTS)		
-54	210-0583-00			4		NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-55	210-0940-00			2		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
-56	210-0223-00			2		TERMINAL,LUG:0.25 INCH DIA,SE	86928	A313-136
						- - - * - - -		
-57	----- -----			1		RESISTOR,VAR:(SEE R9209 REPL)		
						(ATTACHING PARTS)		
-58	358-0422-00			1		BSHG,MACH.THD:0.25-32 X 0.187" LONG BRS	80009	358-0422-00
-59	210-0046-00			2		WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS	78189	1214-05-00-0541C
-60	220-0484-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH AL	80009	220-0484-00
						- - - * - - -		
-61	260-0276-00			1		SWITCH,TOGGLE:DPST,15A,125V	27193	7561 K 4
						(ATTACHING PARTS)		
-62	210-0473-00			1		NUT,PLAIN,DODEC:0.469-32 X 0.638 INCH,BRS	80009	210-0473-00
-63	210-0902-00			1		WASHER,FLAT:0.470 ID X 0.656 INCH OD,STL	12327	OBD
-64	354-0055-00			1		WASHER,KEY:0.469 ID X 0.688 INCH OD,STL	80009	354-0055-00
-65	337-1155-00			1		SHIELD,ELEC:POWER SWITCH	80009	337-1155-00
-66	210-0414-00			1		NUT,PLAIN,HEX.:0.468-32 X 0.562 INCH,BRS	73743	3167-402
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-67	136-0079-00	B101000	B162624	1		LIGHT,INDICATOR:GREEN LENS,W/MTG HARDWARE	71744	5005-262W/GREEN
	----- -----			-		(147A,R147A ONLY)		
	136-0279-00	B162625		1		LIGHT,INDICATOR:GREEN LENS	71744	5160-458-604G
	----- -----			-		(147A,R147A ONLY)		
	136-0079-00	B040500	B112756	1		LIGHT,INDICATOR:GREEN LENS,W/MTG HARDWARE	71744	5005-262W/GREEN
	----- -----			-		(149A/R149A ONLY)		
	136-0279-00	B112757		1		LIGHT,INDICATOR:GREEN LENS	71744	5160-458-604G
	----- -----			-		(149A/R149A ONLY)		
-68	200-0935-00			6		BASE,LAMPHOLDER:0.29 OD X 0.19 CASE	80009	200-0935-00
-69	378-0602-02			2		LENS,LIGHT:RED	80009	378-0602-02
-70	378-0602-01			2		LENS,LIGHT:AMBER	80009	378-0602-01
-71	378-0602-00			2		LENS,LIGHT:GREEN	80009	378-0602-00
-72	352-0157-01			6		LAMPHOLDER:BLACK PLASTIC	80009	352-0157-01
-73	358-0301-00			3		BUSHING,SLEEVE:FOR 0.185 DIA HOLE,GRAY	80009	358-0301-00
-74	333-1458-05	B101000	B131419	1		PANEL,FRONT:	80009	333-1458-05
	----- -----			-		(147A ONLY)		
	333-1458-07	B131420		1		PANEL,FRONT:	80009	333-1458-07
	----- -----			-		(147A ONLY)		
	333-1458-08	B131420		1		PANEL,FRONT:OPTION 1 ONLY	80009	333-1458-08
	----- -----			-		(147A OPTION 1 ONLY)		
	333-1689-02	B040500	B080859	1		PANEL,FRONT:	80009	333-1689-02
	----- -----			-		(149A ONLY)		
	333-1689-03	B080860		1		PANEL,FRONT:	80009	333-1689-03
	----- -----			-		(149A OPTION 1 ONLY)		
	333-1689-04	B080860		1		PANEL,FRONT:	80009	333-1689-04
	----- -----			-		(149A ONLY)		
						(ATTACHING PARTS)		
-75	211-0107-00			4		SCREW,MACHINE:1-72 X 0.312 INCH,RDH SST	12360	OBD
						- - - * - - -		
-76	333-1433-01			1		PANEL,FRONT:	80009	333-1433-01
	----- -----			-		(147A ONLY)		
	333-1651-01			1		PANEL,FRONT:	80009	333-1651-01
	----- -----			-		(149A ONLY)		
-77	386-1663-00			1		PLATE,HDL MTG:ALUMINUM	80009	386-1663-00
						(ATTACHING PARTS)		
-78	212-0068-00			2		SCREW,MACHINE:8-32 X 0.312 INCH,TRH STL	77250	OBD
	----- -----			-		(147A ONLY)		
						- - - * - - -		
-79	367-0037-00			1		. HANDLE,CARRYING:	80009	367-0037-00
						(ATTACHING PARTS)		
-80	212-0506-00			2		. SCREW,MACHINE:10-32 X 0.375 INCH,FLH STL	83385	OBD
-81	344-0098-00			2		. CLIP,DECORATIVE:CARRYING HANDLE,STL NP	80009	344-0098-00
						- - - * - - -		
	390-0112-00	B101000	B142289	1		COVER,GEN:TOP	80009	390-0112-00
	----- -----			-		(147A ONLY)		
	390-0309-00	B014290		2		COVER,CAL FXTR:TOP	80009	390-0309-00
	----- -----			-		(147A ONLY)		
	200-1394-03	XB142290		1		DOOR,ACCESS:	80009	200-1394-03
	----- -----			-		(147A ONLY)		
						(ATTACHING PARTS)		
	210-0586-00	XB142290		3		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	83385	OBD
	----- -----			-		(147A ONLY)		
						- - - * - - -		
-82	355-0134-00			2		. STUD,TURNLOCK F:FLAT HEAD STEEL	94222	82-14-140-16
	----- -----			-		. (147A ONLY)		
-83	355-0135-00			12		. STUD TURNLOCK F:OVH STEEL,FOR0.12" THK PNL	94222	82-11-120-16
	----- -----			-		. (147A ONLY)		
-84	214-0389-00			14		. FSTNR,RETAINER:SPLIT RING	94222	82-32-101-17
	----- -----			-		. (147A ONLY)		
-85	390-0309-00			1		COVER,CAL FXTR:TOP	80009	390-0309-00
	----- -----			-		(149A ONLY)		
						(ATTACHING PARTS)		
	210-0586-00			3		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	83385	OBD
	----- -----			-		(149A ONLY)		
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-	----- -----			-		CABINET TOP INCLUDES:		
	355-0134-00			2		. STUD,TURNLOCK F:FLAT HEAD STEEL	94222	82-14-140-16
	----- -----			-		. (149A ONLY)		
	355-0135-01			12		. STUD TURNLOCK F:OVH STEEL,FOR0.14" THK PNL	94222	82-11-140-16
	----- -----			-		. (149A ONLY)		
	214-0389-00			14		. FSTNR,RETAINER:SPLIT RING	94222	82-32-101-17
	----- -----			-		. (149A ONLY)		
-86	200-1934-03			1		. DOOR,ACCESS:	80009	200-1934-03
	----- -----			-		. (149A ONLY)		
-87	355-0135-01			1		. . STUD TURNLOCK F:OVH STEEL,FOR0.14" THK PNL	94222	82-11-140-16
	----- -----			-		. . (149A ONLY)		
	214-0389-00			1		. . FSTNR,RETAINER:SPLIT RING	94222	82-32-101-17
	----- -----			-		. . (149A ONLY)		
-88	390-0063-00			1		COVER,CAL FXTR:BOTTOM	80009	390-0063-00
-89	355-0134-00			2		. STUD,TURNLOCK F:FLAT HEAD STEEL	94222	82-14-140-16
-90	355-0135-00			12		. STUD TURNLOCK F:OVH STEEL,FOR0.12" THK PNL	94222	82-11-120-16
-91	214-0389-00			14		. FSTNR,RETAINER:SPLIT RING	94222	82-32-101-17
-92	386-1987-00			1		SUBPANEL,FRONT:	80009	386-1987-00
						(ATTACHING PARTS)		
-93	211-0538-00			4		SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
-94	210-0457-00			9		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-95	390-0065-00			1		COVER,CAL FXTR:RIGHT	80009	390-0065-00
	----- -----			-		(147A ONLY)		
	390-0307-00			1		PANEL,CAL FXTR:RIGHT SIDE	80009	390-0307-00
	----- -----			-		(149A ONLY)		
						(ATTACHING PARTS)		
-96	211-0538-00			7		SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
	210-0457-00			7		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-97	348-0048-00			4		FOOT,CAMERA:BLACK VINYL,W/6-32 STUD	80009	348-0048-00
-98	348-0048-00			4		FOOT,CAMERA:BLACK VINYL,W/6-32 STUD	80009	348-0048-00
						(ATTACHING PARTS)		
-99	210-0457-00			2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-100	124-0216-00			2		STRIP,TRIM:CORNER	80009	124-0216-00
						(ATTACHING PARTS)		
-101	212-0068-00			4		SCREW,MACHINE:8-32 X 0.312 INCH,TRH STL	77250	OBD
						- - - * - - -		
-102	390-0065-00	B101000	B142289	1		COVER,CAL FXTR:RIGHT	80009	390-0065-00
	----- -----			-		(147A ONLY)		
	390-0307-00	B142290		1		PANEL,CAL FXTR:RIGHT SIDE	80009	390-0307-00
	----- -----			-		(147A ONLY)		
						(ATTACHING PARTS)		
	211-0538-00			7		SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
	210-0457-00			7		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
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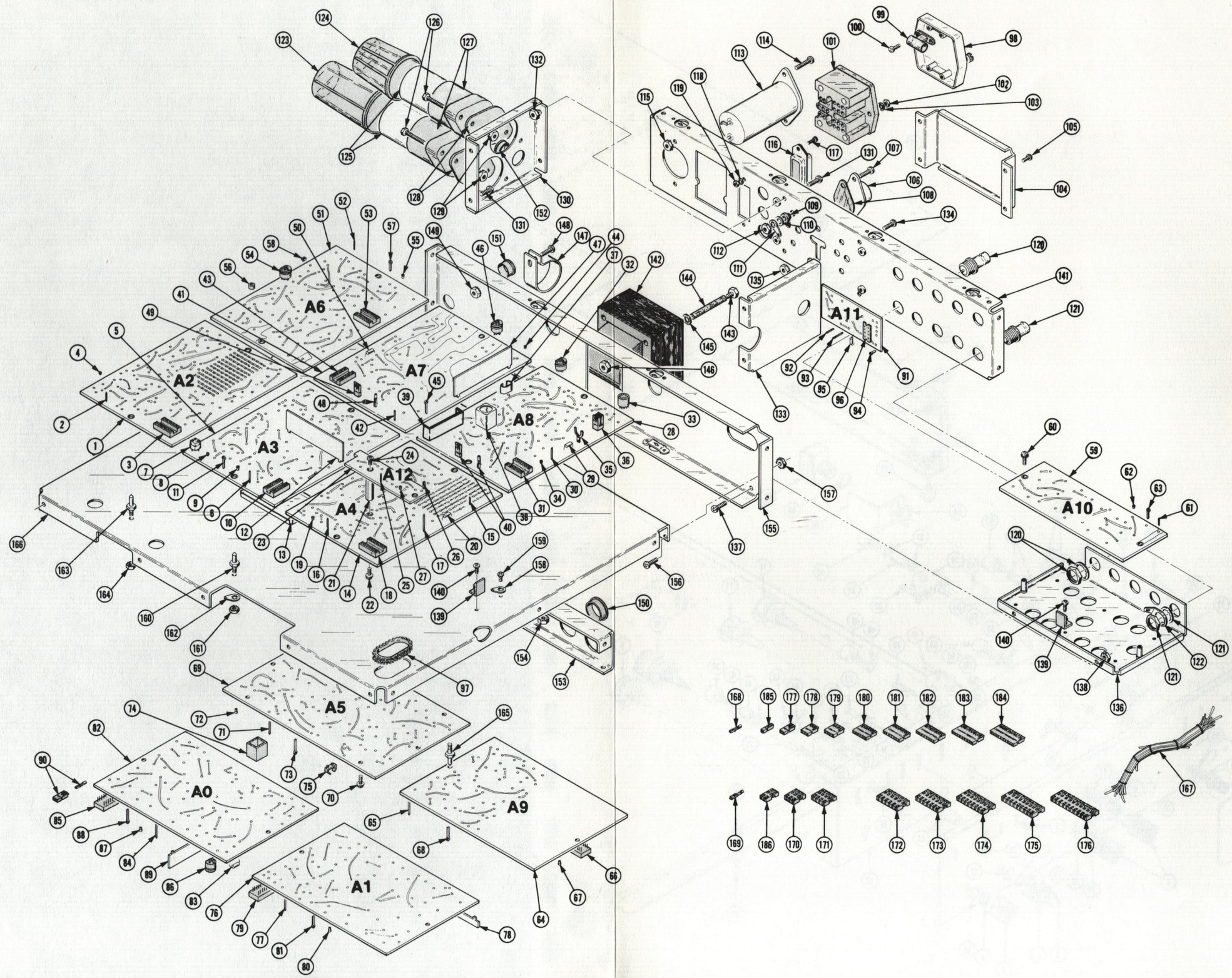

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Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-1	----- -----			1	CKT BOARD ASSY:HORIZONTAL TIMING(SEE A2 REPL)		
-2	131-0608-00			438	. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-3	136-0269-02			20	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-	. (147A ONLY)		
	136-0269-02			19	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-	. (149A ONLY)		
-4	136-0252-07			48	. SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
	----- -----			-	. (147A ONLY)		
	136-0220-00			1	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A ONLY)		
	136-0235-00			48	. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
	----- -----			-	. (149A ONLY)		
	136-0260-02			1	. SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
	----- -----			-	. (149A ONLY)		
-5	----- -----			1	CKT BOARD ASSY:APL STAIRCASE NOISE(SEE A3 REPL)		
-6	131-0608-00			78	. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			-	. (147A ONLY)		
-7	136-0220-00	B101000	B162424X	4	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A ONLY)		
	136-0220-00	B040500	B112324X	4	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A)		
-8	136-0220-00	B101000	B162424X	29	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A ONLY)		
	136-0220-00	B040500	B112324X	29	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A ONLY)		
	136-0252-04			102	. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
	----- -----			-	. (149A ONLY)		
-9	136-0352-00			1	. CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN	00779	50462-7
	----- -----			-	. (147A ONLY)		
-10	136-0269-02			8	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-	. (147A ONLY)		
	136-0269-02			20	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-	. (149A ONLY)		
-11	214-0579-00			4	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-12	337-1456-00			2	. SHLD,ELECTRICAL:CKT CARD MOUNT	80009	337-1456-00
	----- -----			-	. (147A ONLY)		
-13	337-1512-00			1	. SHLD,ELECTRICAL:CIRCUIT CARD MOUNT	80009	337-1512-00
	----- -----			-	. (147A ONLY)		
	131-0589-00			8	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-	. (149A ONLY)		
	136-0260-02			2	. SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
	----- -----			-	. (149A ONLY)		
	131-0993-00			2	. BUS,CONDUCTOR:2 WIRE BLACK	00779	850100-01
	----- -----			-	. (149A ONLY)		
	131-0993-06			1	. LINK,TERM.CONNE:2 WIRE BLUE	00779	850100-6
	----- -----			-	. (149A ONLY)		
	131-0993-09			1	. LINK,TERM.CONNE:2 WIRE WHITE	00779	530153-1
	----- -----			-	. (149A ONLY)		
	131-0707-00			6	. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	47439
	----- -----			-	. (149A ONLY)		
	352-0177-00			1	. CONN BODY,PL,EL:6 WIRE,DBL ROW BLACK	80009	352-0177-00
	----- -----			-	. (149A ONLY)		
-14	----- -----			1	CKT BOARD ASSY:FULL FIELD AND VITS(SEE A4 REPL)		
-15	131-0608-00			217	. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-16	131-0589-00	B101000	B131949	90	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-	. (147A ONLY)		
	131-0589-00	B131950		78	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-	. (147A ONLY)		
	131-0589-00	B040500	B081409	90	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-	. (149A ONLY)		
	131-0589-00	B081410		78	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-	. (149A ONLY)		
-17	131-0592-00			8	. CONTACT,ELEC:0.885 INCH LONG	22526	47353
-18	136-0269-02			18	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
-19	136-0252-07			48	. SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	136-0220-00	B101000	B162424X	8		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A/R147A)		
	136-0220-00	B040500	B112324X	8		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A/R149A)		
-20	131-0566-00	XB111200		1		. BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
	131-0993-00			2		. BUS,CONDUCTOR:2 WIRE BLACK	00779	850100-01
	----- -----			-		. (149A ONLY)		
	131-0993-01			3		. LINK,TERM.CONNE:2 WIRE BROWN	00779	850100-9
	----- -----			-		. (149A ONLY)		
	131-0993-02			3		. LINK,TERM.CONNE:2 WIRE RED	00779	1-850100-0
	----- -----			-		. (149A ONLY)		
	131-0993-03			2		. LINK,TERM.CONNE:2 WIRE ORANGE	00779	850100-3
	----- -----			-		. (149A ONLY)		
	131-0993-04			2		. LINK,TERM.CONNE:2 WIRE YELLOW	00779	850100-4
	----- -----			-		. (149A ONLY)		
	131-0993-05			2		. LINK,TERM.CONNE:2 WIRE GREEN	00779	850100-5
	----- -----			-		. (149A ONLY)		
	131-0993-06			3		. LINK,TERM.CONNE:2 WIRE BLUE	00779	850100-6
	----- -----			-		. (149A ONLY)		
-21	220-0449-00			1		NUT,SLEEVE:4-40 X 0.188 X 0.50" LONG	80009	220-0449-00
						(ATTACHING PARTS)		
-22	211-0116-00			1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	342-0166-00			1		INSULATOR,PLATE:TRANSISTOR	80009	342-0166-00
						- - - * - - -		
-23	----- -----			1		CKT BOARD ASYS:ALT APL(SEE A12 REPL)		
						(ATTACHING PARTS)		
-24	211-0116-00	B101000	B062607	1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	----- -----			-		(147A ONLY)		
	211-0292-00	B062608		1		SCR,ASSEM WSHR:4-40 X 0.29,BRS NI PL	78189	OBD
	----- -----			-		(147A ONLY)		
	211-0116-00	B040500	B112621	1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	----- -----			-		(149A ONLY)		
	211-0292-00	B112622		1		SCR,ASSEM WSHR:4-40 X 0.29,BRS NI PL	78189	OBD
	----- -----			-		(149A ONLY)		
						- - - * - - -		
	----- -----			-		CKT BOARD ASSEMBLY INCLUDES:		
-25	131-0589-00			12		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-26	136-0263-03	B101000	B131629	8		. SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	00779	85864-2
	----- -----			-		. (147A ONLY)		
	136-0263-04	B131630		8		. SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	22526	75377-001
	----- -----			-		. (147A ONLY)		
	136-0263-03	B040500	B081119	8		. SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	00779	85864-2
	----- -----			-		. (149A ONLY)		
	136-0263-04	B081120		8		. SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	22526	75377-001
	----- -----			-		. (149A ONLY)		
-27	136-0252-04			42		. SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-28	----- -----			1		CKT BOARD ASSY:MODULATOR(SEE A8 REPL)		
-29	131-0566-00	XB101000		1		. BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
	----- -----			-		. (147A ONLY)		
-30	131-0589-00			53		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-		. (147A ONLY)		
	131-0589-00			43		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-		. (149A ONLY)		
	131-0608-00			7		. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-31	136-0269-02			3		. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-		. (147A ONLY)		
	136-0269-02			1		. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-		. (149A ONLY)		
-32	136-0235-00			2		. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-33	136-0241-00	B101000	B162623X	1		. SKT,PL-IN ELEK:MICROCIRCUIT,10 CONT,PCB MT	71785	133-99-12-064
	----- -----			-		. (147A ONLY)		
	136-0241-00	B040500	B112732X	2		. SKT,PL-IN ELEK:MICROCIRCUIT,10 CONT,PCB MT	71785	133-99-12-064
	----- -----			-		. (149A ONLY)		
-34	136-0220-00	B101000	B162424	28		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A/R147A ONLY)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	136-0220-00	B162425		1		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A/R147A)		
	136-0220-00	B040500	B112324	28		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A/R149A)		
	136-0220-00	B112325		7		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A/R149A)		
	214-0506-00			2		. CONTACT,ELEC:0.045 SQ X 0.375 INCH L	80009	214-0506-00
-35	352-0134-00			2		. HOLDER,COIL:TOROIDAL,0.472 X 0.417 INCH	80009	352-0134-00
	131-0993-05			1		. LINK,TERM.CONNE:2 WIRE GREEN	00779	850100-5
	----- -----			-		. (149A ONLY)		
-36	131-1611-00			1		. LINK,TERM.CONNE:DOUBLE ROW BLACK	80009	131-1611-00
	----- -----			-		. (149A ONLY)		
-37	200-0715-00			1		. COVER,HT STAB:TO-92,BLACK VINYL	80009	200-0715-00
	----- -----			-		. (149A ONLY)		
	214-0579-00			5		. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	----- -----			-		. (149A ONLY)		
-38	337-1417-00			1		. SHIELD,ELEC:0.55 SQ X 0.685 INCH HIGH	80009	337-1417-00
	----- -----			-		. (149A ONLY)		
-39	337-1755-00			1		. SHLD,ELECTRICAL:CKT BOARD MT	80009	337-1755-00
	----- -----			-		. (149A ONLY)		
-40	131-0993-03			1		. LINK,TERM.CONNE:2 WIRE ORANGE	00779	850100-3
-41	----- -----			1		CKT BOARD ASSY:OUTPUT AMP(SEE A7 REPL)		
-42	131-0589-00			58		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	131-0608-00			9		. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-43	136-0269-02			1		. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
-44	136-0352-00			32		. CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN	00779	50462-7
-45	214-0579-00			3		. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-46	136-0235-00			2		. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
	136-0220-00	B040500	B112324	18		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A ONLY)		
	136-0220-00	B112325		1		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A ONLY)		
	136-0183-00	B101000	B162424X	2		. SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
	----- -----			-		. (147A,R147A ONLY)		
	136-0183-00	B040500	B112324X	2		. SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
	----- -----			-		. (149A ONLY)		
	136-0235-00			4		. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
	----- -----			-		. (147A ONLY)		
	136-0220-00	B101000	B162424	22		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A ONLY)		
	136-0220-00	B162425		1		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A ONLY)		
-47	337-1456-00			3		. SHLD,ELECTRICAL:CKT CARD MOUNT	80009	337-1456-00
-48	131-0707-00			4		. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	47439
-49	131-0993-07			1		. LINK,TERM.CONNE:2 WIRE VIOLET	00779	850100-7
	131-0993-08			1		. LINK,TERM.CONNE:2 WIRE GRAY	00779	850100-8
-50	131-0566-00			1		. BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
	136-0514-00			1		. SKT,PL-IN ELEC:MICROCIRCUIT,8 DIP	73803	CS9002-8
-51	----- -----			1		CKT BOARD ASSY:FUNCTION GEN(SEE A6 REPL)		
-52	131-0589-00	B101000	B131949	38		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-		. (147A ONLY)		
	131-0589-00	B131950		16		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-		. (147A ONLY)		
	131-0589-00	B040500	B081409	40		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-		. (149A ONLY)		
	131-0589-00	B081410		16		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-		. (149A ONLY)		
	214-0817-00	XB162425		1		. HEAT SINK,XSTR:	14566	A11193-T05
	----- -----			-		. (147A/R147A ONLY)		
	214-0817-00	XB112325		1		. HEAT SINK,XSTR:	14566	A11193-T05
	----- -----			-		. (149A/R149A ONLY)		
	131-0608-00			6		. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-53	136-0269-02			1		. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
-54	136-0235-00			2		. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-55	136-0252-07			3		. SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-	136-0183-00	B101000	B162424X	4	. SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
	----- -----			-	. (147A/R147A)		
	136-0183-00	B040500	B112324X	4	. SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
	----- -----			-	. (149A/R149A ONLY)		
	136-0220-00	B101000	B162424	37	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A ONLY)		
	136-0220-00	B162425		4	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A ONLY)		
	136-0220-00	B040500	B112324	35	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A ONLY)		
	136-0220-00	B112325		4	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A ONLY)		
-56	276-0507-00			1	. SHIELDING BEAD,:FERRITE	78488	57-3443
-57	214-0579-00			1	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-58	344-0108-00	B101000	B159999X	8	. CLIP,ELECTRICAL:FOR 0.045" OD SEMICOND D	80009	344-0108-00
	----- -----			-	. (147A ONLY)		
	344-0108-00	B040500	B109999X	8	. CLIP,ELECTRICAL:FOR 0.045" OD SEMICOND D	80009	344-0108-00
	----- -----			-	. (149A ONLY)		
	131-0993-03			1	. LINK,TERM.CONNE:2 WIRE ORANGE	00779	850100-3
	131-0993-07			1	. LINK,TERM.CONNE:2 WIRE VIOLET	00779	850100-7
	200-0945-01			1	. COVER,HALF XSTR:DUAL TO-18,W/2-56 THD	80009	200-0945-01
					(ATTACHING PARTS)		
	211-0001-00			1	. SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	87308	OBD
					- - - * - - -		
	200-0945-00			1	. COVER,HALF XSTR:DUAL TO-18,ALUMINUM	80009	200-0945-00
-59	----- -----			1	CKT BOARD ASSY:POWER SUPPLY(SEE A10 REPL)		
					(ATTACHING PARTS)		
-60	211-0116-00	B101000	B062607	2	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	----- -----			-	(147A ONLY)		
	211-0292-00	B062608		2	SCR,ASSEM WSHR:4-40 X 0.29,BRS NI PL	78189	OBD
	----- -----			-	(147A ONLY)		
	211-0116-00	B040500	B061293	2	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	----- -----			-	(149A ONLY)		
	211-0292-00	B061294		2	SCR,ASSEM WSHR:4-40 X 0.29,BRS NI PL	78189	OBD
	----- -----			-	(149A ONLY)		
					- - - * - - -		
	----- -----			-	CKT BOARD ASSY INCLUDES:		
-61	131-0589-00			57	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-62	136-0220-00	B101000	B162424	12	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A/R147A ONLY)		
	136-0220-00	B162425		7	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A/R147A ONLY)		
	136-0220-00	B040500	B112324	12	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A ONLY)		
	136-0220-00	B112325		7	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A ONLY)		
-63	214-0579-00			4	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	200-0945-01			2	. COVER,HALF XSTR:DUAL TO-18,W/2-56 THD	80009	200-0945-01
					(ATTACHING PARTS)		
	211-0001-00			2	. SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	87308	OBD
					- - - * - - -		
	200-0945-00			2	. COVER,HALF XSTR:DUAL TO-18,ALUMINUM	80009	200-0945-00
-64	----- -----			1	CKT BOARD ASSY:SUBCARRIER AND SYNC(SEE A9 REPL)		
-65	131-0589-00			41	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-	. (147A ONLY)		
	131-0589-00			78	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	----- -----			-	. (149A ONLY)		
	131-0608-00			9	. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	----- -----			-	. (149A ONLY)		
-66	136-0269-02			4	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-	. (147A ONLY)		
	136-0269-02			7	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
	----- -----			-	. (149A ONLY)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-67	136-0252-07			62	. SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
	----- -----			-	. (147A ONLY)		
	136-0252-07			56	. SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
	----- -----			-	. (149A ONLY)		
	136-0220-00	B101000	B162424X	17	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A ONLY)		
	136-0220-00	B040500	B112324X	17	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A)		
	136-0183-00	B010100	B112324X	1	. SOCKET,PLUG-IN:3 PIN,ROUND	80009	136-0183-00
	----- -----			-	. (149A ONLY)		
-68	214-0579-00			1	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	131-0993-02			3	. LINK,TERM.CONNE:2 WIRE RED	00779	1-850100-0
	----- -----			-	. (149A ONLY)		
-69	----- -----			1	CKT BOARD ASSY:GEN LOCK(SEE A5 REPL)		
					(ATTACHING PARTS)		
-70	211-0116-00	B101000	B062607	4	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	----- -----			-	(147A ONLY)		
	211-0292-00	B062608		4	SCR,ASSEM WSHR:4-40 X 0.29,BRS NI PL	78189	OBD
	----- -----			-	(147A ONLY)		
	211-0116-00	B040500	B112621	4	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	----- -----			-	(149A ONLY)		
	211-0292-00	B112622		4	SCR,ASSEM WSHR:4-40 X 0.29,BRS NI PL	78189	OBD
	----- -----			-	(149A ONLY)		
					- - - * - - -		
	----- -----			-	CKT BOARD ASSY INCLUDES:		
-71	131-0589-00			20	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	131-0608-00			3	. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-72	136-0220-00	B101000	B162424	76	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A/R147A ONLY)		
	136-0220-00	B162425		1	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A/R147A ONLY)		
	136-0220-00	B040500	B112324	76	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A ONLY)		
	136-0220-00	B112325		1	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A ONLY)		
	136-0234-00	B101000	B131779	2	. SOCKET,PIN TERM:0.088 OD X 0.247 INCH L	00779	380598-1
	----- -----			-	. (147A ONLY)		
	136-0674-00	B131780		2	. SKT,PIN TERM.:FOR 0.048 DIA PIN	00779	1-380758-0
	----- -----			-	. (147A ONLY)		
	136-0234-00	B040500	B081289	2	. SOCKET,PIN TERM:0.088 OD X 0.247 INCH L	00779	380598-1
	----- -----			-	. (149A ONLY)		
	136-0674-00	B081290		2	. SKT,PIN TERM.:FOR 0.048 DIA PIN	00779	1-380758-0
	----- -----			-	. (149A ONLY)		
-73	214-0579-00			16	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	131-0993-06			1	. LINK,TERM.CONNE:2 WIRE BLUE	00779	850100-6
-74	337-1417-00			1	. SHIELD,ELEC:0.55 SQ X 0.685 INCH HIGH	80009	337-1417-00
-75	352-0096-00			1	. CLIP,SPR,TNSN:CRYSTAL	80009	352-0096-00
	210-0994-00	XB162613		4	. WASHER,FLAT:0.125 ID X 0.25" OD,STL	86928	5702-201-20
	----- -----			-	. (147A ONLY)		
	210-0994-00	XB112673		4	. WASHER,FLAT:0.125 ID X 0.25" OD,STL	86928	5702-201-20
	----- -----			-	. (149A ONLY)		
-76	----- -----			1	CKT BOARD ASSY:VERTICAL COUNTER(SEE A1 REPL)		
-77	131-0589-00			43	. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-78	131-0998-00			5	. BUS BAR:9 TERM,8.132"LONG,CUT TO FIT	80009	131-0998-00
-79	136-0269-02			18	. SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLE	73803	CS9002-14
-80	136-0220-00	B101000	B162424	18	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A/R147A ONLY)		
	136-0220-00	B162425		2	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (147A/R147A ONLY)		
	136-0220-00	B040500	B112324	18	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A ONLY)		
	136-0220-00	B112325		2	. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-	. (149A/R149A ONLY)		
-81	214-0579-00			16	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-82	----- -----			1	CKT BOARD ASSY:VIT INSERTION(SEE A0 REPL)		
	276-0507-00			1	. SHIELDING BEAD,:FERRITE	78488	57-3443

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-83	131-0566-00			1		. BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
-84	131-0589-00			66		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	131-0608-00			6		. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-85	136-0260-02			2		. SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CLE	71785	133-51-92-008
-86	136-0235-00			1		. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-87	136-0220-00	B101000	B162424	31		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A/R147A ONLY)		
	136-0220-00	B162425		4		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A/R147A ONLY)		
	136-0220-00	B040500	B112324	31		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A/R149A ONLY)		
	136-0220-00	B112325		4		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A/R149A ONLY)		
-88	214-0579-00			7		. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-89	337-1456-00			1		. SHLD,ELECTRICAL:CKT CARD MOUNT	80009	337-1456-00
-90	131-0993-00			1		. BUS,CONDUCTOR:2 WIRE BLACK	00779	850100-01
	----- -----			-		. (147A ONLY)		
-91	----- -----			1		CKT BOARD ASSY:RELAY AND DELAY(SEE A11 REPL)		
-92	131-0608-00			6		. TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
-93	131-0589-00			16		. TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-94	136-0252-07			8		. SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
	136-0220-00	B101000	B162424X	2		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (147A/R147A ONLY)		
	136-0220-00	B040500	B112324X	2		. SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT,PCB MT	71785	133-23-11-034
	----- -----			-		. (149A/R149A ONLY)		
-95	131-0566-00			1		. BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
-96	136-0337-00			2		. SOCKET,PLUG-IN:8 PIN RELAY	80009	136-0337-00
-97	255-0334-00			FT		PLASTIC CHANNEL:12.75 X 0.175X 0.155,NYL	11897	122-37-2500
-98	200-0762-00			1		COV ASSY,LINE V:WITH FUSEHOLDER,115/230V	80009	200-0762-00
-99	352-0102-00			2		. FUSEHOLDER:0.262"ID TUBE FOR CRTG FUSE	80009	352-0102-00
						(ATTACHING PARTS)		
-100	213-0088-00			2		. SCR,TPG,THD CTG:4-24 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-101	204-0279-00			1		BODY ASSY,LINE:115/230 VOLTS	80009	204-0279-00
						(ATTACHING PARTS)		
-102	210-0407-00			2		NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
-103	210-0006-00			2		WASHER,LOCK:#6 INTL,0.018THK,STL CD PL	78189	1206-00-00-0541C
						- - - * - - -		
-104	200-0918-03			1		COV,TRANSISTOR:	80009	200-0918-03
						(ATTACHING PARTS)		
-105	211-0008-00			4		SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL	83385	OBD
						- - - * - - -		
-106	----- -----			2		TRANSISTOR:(SEE Q9035,Q9055 REPL)		
						(ATTACHING PARTS)		
-107	211-0510-00			4		SCREW,MACHINE:6-32 X 0.375,PNH,STL,CD PL	83385	OBD
-108	386-0978-00			2		INSULATOR,PLATE:TRANSISTOR,MICA	80009	386-0978-00
-109	210-0975-00			4		WSHR,SHOULDERED:0.14 ID X 0.247" OD,PLSTC	80009	210-0975-00
-110	210-0803-00			4		WASHER,FLAT:0.15 ID X 0.032 THK,STL CD PL	12327	OBD
-111	210-0202-00			2		TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED	78189	2104-06-00-2520N
-112	210-0457-00			4		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
	----- -----			1		TRANSISTOR:(SEE Q9085 REPL)		
						(ATTACHING PARTS)		
	211-0510-00			2		SCREW,MACHINE:6-32 X 0.375,PNH,STL,CD PL	83385	OBD
	386-0143-00			1		INSULATOR,PLATE:TRANSISTOR MICA	02735	DF31A
	210-0935-00			2		WASHER,NONMETAL:FIBER,0.14 IDX 0.375"OD	74921	OBD
	210-0803-00			2		WASHER,FLAT:0.15 ID X 0.032 THK,STL CD PL	12327	OBD
	210-0202-00			1		TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED	78189	2104-06-00-2520N
	210-0457-00			2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-113	----- -----			1		LINE FILTER:(SEE FL9201 REPL)		
						(ATTACHING PARTS)		
-114	211-0507-00	B101000	B131859	2		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	----- -----			-		(147A ONLY)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	211-0012-00	B131860		2		SCREW,MACHINE:4-40 X 0.375,PNH STL CD PL	83385	OBD
	----- -----			-		(147A ONLY)		
	211-0507-00	B040500	B081359	2		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	----- -----			-		(149A ONLY)		
	211-0012-00	B081360		2		SCREW,MACHINE:4-40 X 0.375,PNH STL CD PL	83385	OBD
	----- -----			-		(149A ONLY)		
-115	210-0457-00	B101000	B131859	2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
	----- -----			-		(147A ONLY)		
	210-0586-00	B131860		2		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	83385	OBD
	----- -----			-		(147A ONLY)		
	210-0457-00	B040500	B081359	2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
	----- -----			-		(149A ONLY)		
	210-0586-00	B081360		2		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	83385	OBD
	----- -----			-		(149A ONLY)		
	210-0202-00	XB131860		1		TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED	78189	2104-06-00-2520N
	----- -----			-		(147A ONLY)		
	210-0202-00	XB081360		1		TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED	78189	2104-06-00-2520N
	----- -----			-		(149A ONLY)		
						- - - * - - -		
-116	131-0324-00			1		CONNECTOR,RCPT,:24 PIN,FEMALE	71785	222-42-24-060
						(ATTACHING PARTS)		
-117	211-0062-00			2		SCREW,MACHINE:2-56 X 0.312,PNH,STL	83385	OBD
-118	210-0001-00			2		WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL	78189	1202-00-00-0541C
-119	210-0405-00			2		NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS	73743	12157-50
						- - - * - - -		
-120	131-0274-00			1		CONNECTOR,RCPT,:BNC	91836	KC79-67
-121	131-0126-00	B101000	B131659	12		CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
	131-0126-00	B131660		10		CONNECTOR,RCPT,:BNC,FEMALE	77820	9663-1 NT-34
						(ATTACHING PARTS)		
-122	210-0241-00			1		TERMINAL,LUG:0.515 ID X 0.625 INCH OD SE	80009	210-0241-00
						- - - * - - -		
	134-0156-00	XB131650		2		BUTTON,PLUG:0.5 HOLE	77132	SS48152-K1110
-123	200-0293-00			1		SHLD,CAPACITOR:2.563 INCHES LONG	80009	200-0293-00
-124	200-0538-00			1		SHLD,CAPACITOR:1.644 INCHES LONG	80009	200-0538-00
-125	----- -----			2		CAPACITOR:(SEE C9042,C9061 REPL)		
						(ATTACHING PARTS)		
-126	211-0588-00			4		SCREW,MACHINE:6-32 X 0.75 INCH,HEX.HD STL	83385	OBD
-127	432-0048-00			2		BASE,CAP.MTG:GENERAL	80009	432-0048-00
-128	386-0254-00			2		RETAINER,CAP.:LARGE FIBER	98627	OBD
-129	210-0457-00			4		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-130	407-0556-00			1		BRACKET,CAP.:ALUMINUM	80009	407-0556-00
						(ATTACHING PARTTS)		
-131	211-0507-00			4		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-132	210-0457-00			4		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-133	386-1487-00			1		BRACKET,XFMR:	80009	386-1487-00
						(ATTACHING PARTS)		
-134	211-0507-00			4		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	210-0202-00			1		TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED	78189	2104-06-00-2520N
-135	210-0457-00			4		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-136	441-0892-00			1		CHAS,ELEC EQPT:OVEN CKT CARD	80009	441-0892-00
						(ATTACHING PARTS)		
-137	211-0504-00			2		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
-138	210-0457-00			2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-139	344-0133-00			48		CLIP,SPR,TNSN:CIRCUIT CARD MOUNTING	80009	344-0133-00
						(ATTACHING PARTS)		
-140	213-0138-00			1		SCR,TPG,TF:4-24 X 0.188 INCH,PNH STL	83385	OBD
						- - - * - - -		
-141	386-1986-03	B101000	B131859	1		PANEL,REAR:	80009	386-1986-03
	----- -----			-		(147A ONLY)		
	386-1986-04	B131860		1		PANEL,REAR:	80009	386-1986-04
	----- -----			-		(147A ONLY)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	386-1986-03	B040500	B081359	1		PANEL,REAR:	80009	386-1986-03
	----- -----			-		(149A ONLY)		
	386-1986-04	B081360		1		PANEL,REAR:	80009	386-1986-04
	----- -----			-		(149A ONLY)		
-142	----- -----			1		TRANSFORMER:(SEE T9001 REPL)		
						(ATTACHING PARTS)		
-143	212-0516-00			4		SCREW,MACHINE:10-32 X 2 INCH,HEX HD STL	77250	OBD
-144	166-0227-00			4		INS SLV,ELEC:0.187 ID X 1.50 INCH LONG	80009	166-0227-00
-145	210-0812-00			4		WASHER,NONMETAL:#10,FIBER	86445	OBD
-146	220-0410-00			4		NUT,EXTENDED WA:10-32 X 0.375 INCH,STL	83385	OBD
						- - - * - - -		
-147	343-0320-00			1		CLAMP,LOOP:1.03 INCH MINIMUM ID,AL	80009	343-0320-00
						(ATTACHING PARTS)		
-148	211-0507-00			1		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-149	210-0457-00			1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-150	348-0050-00			7		GROMMET,PLASTIC:0.75 INCH DIA	80009	348-0050-00
-151	348-0063-00			4		GROMMET,PLASTIC:0.50 INCH DIA	80009	348-0063-00
-152	348-0064-00			1		GROMMET,PLASTIC:0.625 INCH DIA	80009	348-0064-00
-153	386-1532-00			1		SUPPORT,CHASSIS:MAIN	80009	386-1532-00
						(ATTACHING PARTS)		
-154	210-0457-00			3		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-155	407-0555-00			1		BRACKET,XFMR:ALUMINUM	80009	407-0555-00
						(ATTACHING PARTS)		
-156	211-0507-00			4		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-157	210-0457-00			3		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-158	210-0201-00			7		TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL	86928	OBD
						(ATTACHING PARTS)		
-159	213-0044-00			2		SCR,TPG,THD FOR:5-32 X 0.188 INCH,PNH STL	83385	OBD
						- - - * - - -		
-160	214-1169-00			7		PIN,GUIDE:0.80 INCH LONG	80009	214-1169-00
						(ATTACHING PARTS)		
-161	210-0457-00			1		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
-162	210-0202-00			1		TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED	78189	2104-06-00-2520N
						- - - * - - -		
-163	214-1169-00			5		PIN,GUIDE:0.80 INCH LONG	80009	214-1169-00
						(ATTACHING PARTS)		
-164	210-0457-00			2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-165	214-1621-00			6		PIN,GUIDE:0.74 INCH LONG	80009	214-1621-00
						(ATTACHING PARTS)		
	210-0457-00			2		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	OBD
						- - - * - - -		
-166	441-1008-00			1		CHAS,ELEC EQPT:	80009	441-1008-00
-167	179-1684-02	B101000	B119999	1		WIRING HARNESS,:CHASSIS	80009	179-1684-02
	----- -----			-		(147A ONLY)		
	179-1684-03	B120000		1		WIRING HARNESS,:CHASSIS	80009	179-1684-03
	----- -----			-		(147A ONLY)		
	179-1850-01	B040500	B069999	1		WIRING HARNESS,:CHASSIS	80009	179-1850-01
	----- -----			-		(149A ONLY)		
	179-1850-02	B070000		1		WIRING HARNESS,:CHASSIS	80009	179-1850-02
	----- -----			-		(149A ONLY)		
-168	131-0707-00			96		. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	47439
	131-0708-00			14		. CONTACT,ELEC:0.48"L,28-32 AWG WIRE	22526	47437
	131-0792-00			28		. CONNECTOR,TERM:18-20 AWG,CU BE GOLD PL	22526	46221
-169	131-0621-00			232		. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	46231
	131-0622-00			39		. CONTACT,ELEC:0.577"L,28-32 AWG WIRE	22526	46241
-170	352-0161-00			3		. HLDR,TERM CONN:3 WIRE,BLACK	80009	352-0161-00
	----- -----			-		. (149A ONLY)		
	352-0161-00	B101000	B142224	3		. HLDR,TERM CONN:3 WIRE,BLACK	80009	352-0161-00
	----- -----			-		. (147A ONLY)		
	352-0161-00	B142225		2		. HLDR,TERM CONN:3 WIRE,BLACK	80009	352-0161-00
	----- -----			-		. (147A ONLY)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-171	352-0162-00			2	. HLDR,TERM CONN:4 WIRE BLACK	80009	352-0162-00
-172	352-0164-00			1	. CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0164-00
-173	352-0165-00			2	. CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0165-00
-174	352-0166-00			7	. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0166-00
-175	352-0167-00			2	. HLDR,TERM CONN:9 WIRE BLACK	80009	352-0167-00
-176	352-0168-00			2	. CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00
-177	352-0198-00			7	. HLDR,TERM CONN:2 WIRE BLACK	80009	352-0198-00
	----- -----			-	. (147A ONLY)		
	352-0198-00	B040500	B091880	7	. HLDR,TERM CONN:2 WIRE BLACK	80009	352-0198-00
	----- -----			-	. (149A ONLY)		
	352-0198-00	B091881		8	. HLDR,TERM CONN:2 WIRE BLACK	80009	352-0198-00
	----- -----			-	. (149A ONLY)		
-178	352-0199-00			3	. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0199-00
-179	352-0200-00			6	. HLDR,TERM CONN:4 WIRE BLACK	80009	352-0200-00
-180	352-0201-00			6	. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0201-00
-181	352-0202-00			8	. HLDR,TERM CONN:6 WIRE BLACK	80009	352-0202-00
-182	352-0203-00			4	. HLDR,TERM CONN:7 WIRE BLACK	80009	352-0203-00
-183	352-0204-00			3	. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0204-00
-184	352-0205-00			3	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0205-00
	352-0206-00			15	. HLDR,TERM CONN:10 WIRE BLACK	80009	352-0206-00
	179-1685-00			1	WIRING HARNESS,:POWER	80009	179-1685-00
	131-0621-00			21	. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	46231
	----- -----			-	. (147A ONLY)		
	131-0621-00	B040500	B091880	21	. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	46231
	----- -----			-	. (149A ONLY)		
	131-0621-00	B091881		17	. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	46231
	----- -----			-	. (149A ONLY)		
	352-0203-00			2	. HLDR,TERM CONN:7 WIRE BLACK	80009	352-0203-00
	352-0205-00			1	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0205-00
	179-1686-02			1	WIRING HARNESS,:COAXIAL	80009	179-1686-02
	131-0621-00			1	. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	46231
	131-0622-00			5	. CONTACT,ELEC:0.577"L,28-32 AWG WIRE	22526	46241
	131-0792-00			6	. CONNECTOR,TERM:18-20 AWG,CU BE GOLD PL	22526	46221
	352-0201-00			1	. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0201-00
	352-0206-00			1	. HLDR,TERM CONN:10 WIRE BLACK	80009	352-0206-00
	179-1687-00			1	WIRING HARNESS,:AC	80009	179-1687-00
	----- -----			-	(147A ONLY)		
	131-0707-00	B040500	B091880	136	. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	47439
	----- -----			-	. (149A ONLY)		
	131-0707-00	B091881		134	. CONNECTOR,TERM:22-26 AWG,BRS& CU BE GOLD	22526	47439
	----- -----			-	. (149A ONLY)		
-185	352-0171-00			29	. HLDR,TERM CONN:1 WIRE BLACK	80009	352-0171-00
	352-0171-01			17	. CONN BODY,PL,EL:1 WIRE BROWN	80009	352-0171-01
	352-0171-02			10	. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
	----- -----			-	. (147A ONLY)		
	352-0171-02	B040500	B091880	10	. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
	----- -----			-	. (149A ONLY)		
	352-0171-02	B091881		8	. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
	----- -----			-	. (149A ONLY)		
	352-0171-03			7	. CONN BODY,PL,EL:1 WIRE ORANGE	80009	352-0171-03
	352-0171-04			4	. CONN BODY,PL,EL:1 WIRE YELLOW	80009	352-0171-04
	352-0171-06			1	. CONN BODY,PL,EL:1 WIRE BLUE	80009	352-0171-06
-186	352-0169-00			1	. HLDR,TERM CONN:2 WIRE BLACK	80009	352-0169-00
	352-0164-00			1	. CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0164-00
	352-0166-00			1	. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0166-00
	352-0166-01			1	. CONN BODY,PL,EL:8 WIRE BROWN	80009	352-0166-01
	352-0166-02			1	. HLDR,TERM CONN:8 WIRE,RED	80009	352-0166-02
	352-0166-03			1	. CONN BODY,PL,EL:8 WIRE ORANGE	80009	352-0166-03
	352-0167-00			2	. HLDR,TERM CONN:9 WIRE BLACK	80009	352-0167-00
	352-0168-00			1	. CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-1	367-0102-00			2		HANDLE,BOW:	80009	367-0102-00
						(ATTACHING PARTS)		
-2	212-0004-00			2		SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-3	213-0216-00			2		THUMBSCREW:10-32 X 0.85,0.375 OD HD SST	80009	213-0216-00
						(ATTACHING PARTS)		
-4	354-0025-00			1		RING,RETAINING:0.181 INCH FREE ID	79136	5555-18
-5	210-0894-00			1		WASHER,NONMETAL:0.19 ID X 0.438" OD,PLSTC	09422	OBD
						- - - * - - -		
-6	333-1433-01			1		PANEL,FRONT:	80009	333-1433-00
	----- -----			-		(147A ONLY)		
	333-1651-01			1		PANEL,FRONT:	80009	333-1651-01
	----- -----			-		(149A ONLY)		
-7	407-0510-00			2		BRACKET,ANGLE:RACKMOUNT,ALUMINUM	80009	407-0510-00
						(ATTACHING PARTS)		
-8	212-0004-00			4		SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-9	351-0104-00	B101000	B131849	1		SLIDE SECT,DWR:12.625 X 2.25	06666	C-720-2
	----- -----			-		(147A ONLY)		
	351-0104-03	B131850		1		SLIDE SECT,DWR:12.625 L,W/O HARDWARE	06666	C-720-3
	----- -----			-		(147A ONLY)		
	351-0104-00	B040500	B183559	1		. SLIDE SECT,DWR:12.625 X 2.25	06666	C-720-2
	----- -----			-		(149A ONLY)		
	351-0104-03	B183560		1		. SLIDE SECT,DWR:12.625 L,W/O HARDWARE	06666	C-720-3
	----- -----			-		(149A ONLY)		
						(ATTACHING PARTS)		
-10	212-0004-00			4		SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
	124-0270-00			1		STRIP,TRIM:RIGHT	80009	124-0270-00
	124-0270-01			1		STRIP,TRIM:LEFT	80009	124-0270-01

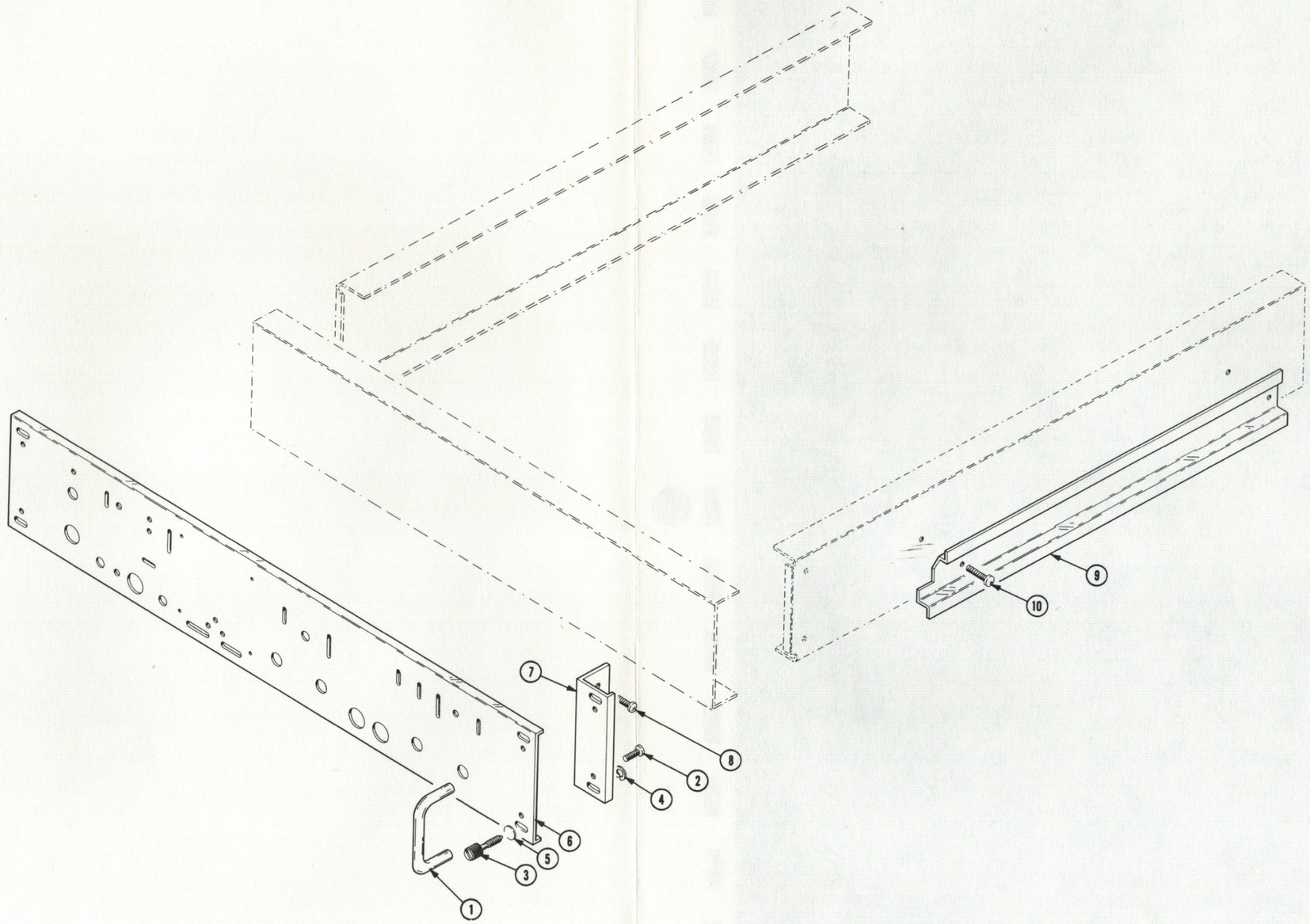


FIG. 3 RACKMOUNTING

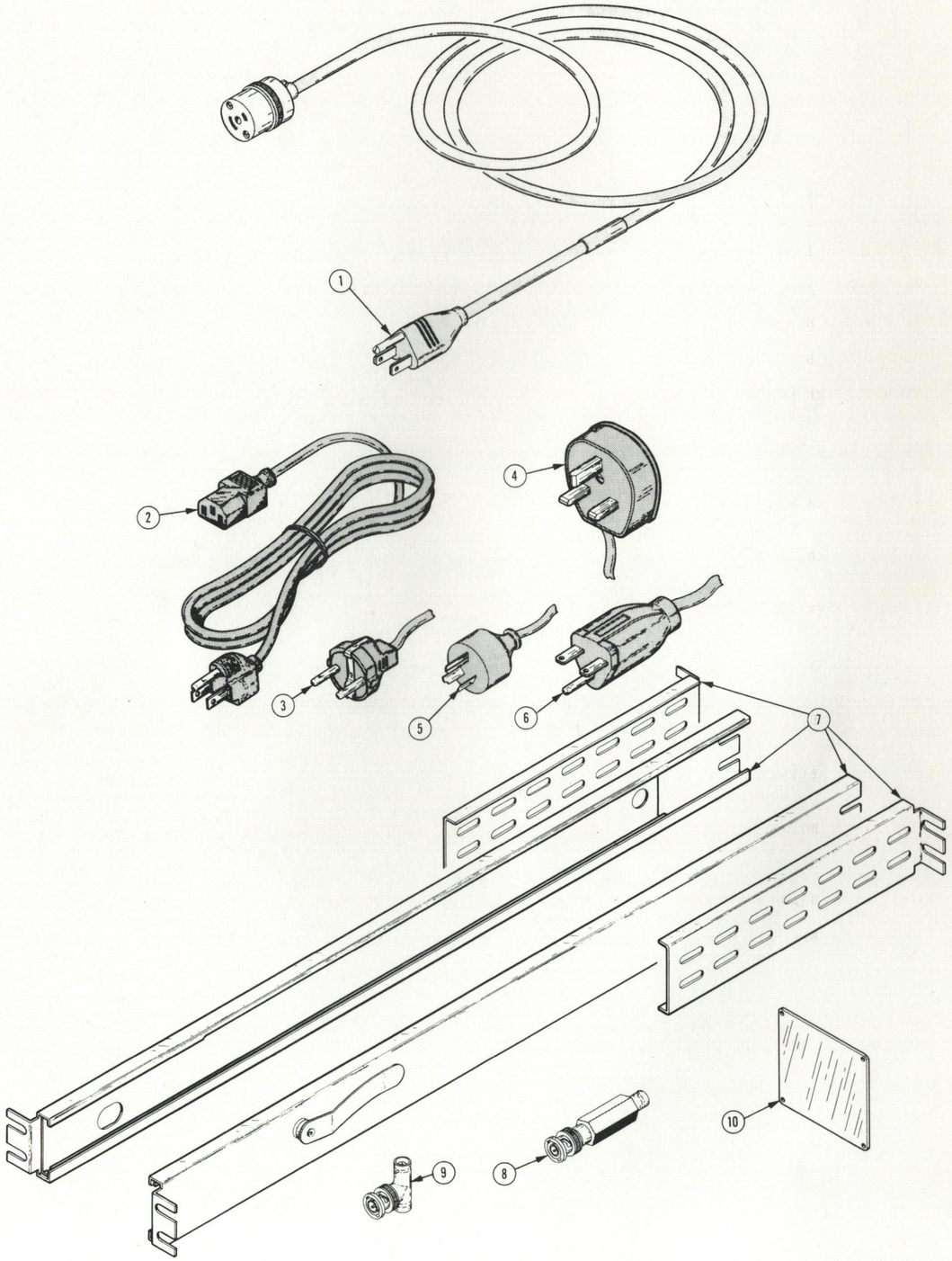


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
-1	161-0036-00	B101000	B131859	1		CABLE ASSY,PWR,:3,18 AWG,115V,90.0 L	80009	161-0036-00
	----- -----			-		(147A ONLY)		
	161-0036-00	B040500	B081359	1		CABLE ASSY,PWR,:3,18 AWG,115V,90.0 L	80009	161-0036-00
	----- -----			-		(149A ONLY)		
-2	161-0066-00	B131860		1		CABLE ASSY,PWR,:3,18 AWG,115V,98.0 L	16428	KH8481
	----- -----			-		(147A ONLY)		
	161-0066-00	B081360		1		CABLE ASSY,PWR,:3,18 AWG,115V,98.0 L	16428	KH8481
	----- -----			-		(149A ONLY)		
-3	161-0066-09	XB162609		1		CABLE ASSY,PWR:3,0.75MM SQ,220V,96.0 L	80126	OBD
	----- -----			-		(147A ONLY)		
	----- -----			-		(A1 EUROPEAN ONLY)		
	161-0066-09	XB112624		1		CABLE ASSY,PWR:3,0.75MM SQ,220V,96.0 L	80126	OBD
	----- -----			-		(149A ONLY)		
	----- -----			-		(A1 EUROPEAN ONLY)		
-4	161-0066-10	XB162609		1		CABLE ASSY,PWR:3,0.75MM SQ,240V,96.0 L	80126	OBD
	----- -----			-		(147A ONLY)		
	----- -----			-		(A2 UNITED KINGDOM ONLY)		
	161-0066-10	XB112624		1		CABLE ASSY,PWR:3,0.75MM SQ,240V,96.0 L	80126	OBD
	----- -----			-		(149A ONLY)		
	----- -----			-		(A2 UNITED KINGDOM ONLY)		
-5	161-0066-11	XB162609		1		CABLE ASSY,PWR:3,0.75MM,240V,96.0L	S3109	OBD
	----- -----			-		(147A ONLY)		
	----- -----			-		(A3 AUSTRALIAN ONLY)		
	161-0066-11	XB112624		1		CABLE ASSY,PWR:3,0.75MM,240V,96.0L	S3109	OBD
	----- -----			-		(149A ONLY)		
	----- -----			-		(A3 AUSTRALIAN ONLY)		
-6	161-0066-12	XB162609		1		CABLE ASSY,PWR:3,18 AWG,240V,96.0 L	80126	OBD
	----- -----			-		(147A ONLY)		
	----- -----			-		(A4 NORTH AMERICAN ONLY)		
	161-0066-12	XB112624		1		CABLE ASSY,PWR:3,18 AWG,240V,96.0 L	80126	OBD
	----- -----			-		(149A ONLY)		
	----- -----			-		(A4 NORTH AMERICAN ONLY)		
-7	351-0195-00	B010100	B162583	1		SLIDE,DWR,EXT:SLIDE,PAIR(RACKMOUNT ONLY)	06666	C719
	----- -----			-		(147A ONLY)		
	351-0195-01	B162584		1		SLIDE,DWR,EXT:W/CLOSED MOUNTING SLOTS	80009	351-0195-01
	----- -----			-		(147A ONLY)		
	351-0195-00	B010100	B112582	1		SLIDE,DWR,EXT:SLIDE,PAIR(RACKMOUNT ONLY)	06666	C719
	----- -----			-		(149A ONLY)		
	351-0195-01	B112583		1		SLIDE,DWR,EXT:W/CLOSED MOUNTING SLOTS	80009	351-0195-01
	----- -----			-		(149A ONLY)		
-8	011-0103-02			1		TERMINATION:75 OHM,BNC	80009	011-0103-02
-9	103-0030-00			2		ADAPTER,CONN:BNC T MALE TO2 FEMALE	95712	3424-0
-10	200-1246-00			1		COVER,FRONT PNL:	80009	200-1246-00
	----- -----			-		(147A ONLY)		
	200-1474-00			1		COVER,FRONT PNL:	80009	200-1474-00
	----- -----			-		(149A ONLY)		
	200-1328-00			1		COVER,PROT:FRONT PANEL	000JG	OBD
	----- -----			-		(149A ONLY)		
	070-2029-00			1		MANUAL,TECH:INSTRUCTION	80009	070-2029-00

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

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MANUAL CHANGE INFORMATION

Date: 2-11-81 Change Reference: C100/281

Product: GENERAL Manual Part No.: GENERAL

DESCRIPTION

WARNING

During rackmount installation, interchanging the left and right slide-out track assemblies defeats the extension stop (safety latch) feature of the tracks. Equipment could, when extended, come out of the slides and fall from the rack, possibly causing personal injury and equipment damage.

When mounting the supplied slide-out tracks, inspect both assemblies to find the LH (left hand) and RH (right hand) designations to determine correct placement. Install the LH assembly to your left side as you face the front of the rack and install the RH assembly to your right side. Refer to the rackmounting instructions in this manual for complete information.

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MANUAL CHANGE INFORMATION

Date: 2-28-83 Change Reference: M46222 Rev.

Product: 149A Series Manual Part No.: 070-2029-00

DESCRIPTION

ADDED REPLACEABLE ELECTRICAL PARTS

Page 7-40,

ADD:

A9	670-2350-06	CKT BOARD ASSY:SUBCARRIER SYNC (SN B112846 & BELOW) (OPTION 01 ONLY)
A9	670-2350-08	CKT BOARD ASSY:SUBCARRIER SYNC (SN B112847 & UP) (OPTION 01 ONLY)

000-2775-00D